MAY 18 1959

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PIPE LINE INDUSTRY

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IDEAS-FOR-FUTURE
Continuous X-Ray of Pipe in One Pass 46

For a "Quick Look" at this issue, turn the page . . .

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Though we've changed the name from Barrett Protective Coatings to Allied Chemical, you'll still receive the same famous protection in Pipeline Coatings which have been proved and improved for three generations. Write for full information.

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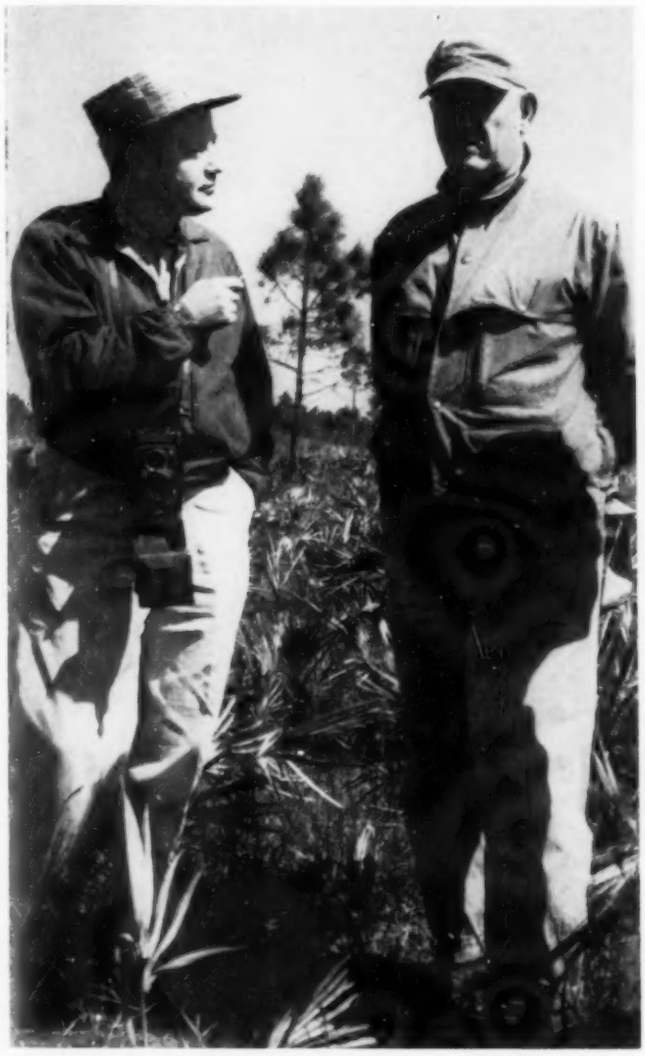
MAY 18 1959

PIPE LINE INDUSTRY

CONTENTS and Quick Look

May, 1959 Vol. 10, No. 5

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.



Florida Line Brings New Ideas in Pipelining

☐ During construction of Houston Texas Gas and Oil Corporation's main line near Vero Beach, Fla., Editor Melvin A. Judah (left), gathers information about Harbert Construction Corporation's progress from Clyde Farris, welding inspector. Features of the line include: Mill double jointing used extensively, polyethylene tape used to coat entire line, new construction ideas to cross marsh and sand, and advances in compressor station design.

By Melvin A. Judah and Donald G. DePugh ..... Page 18

New 13,400 HP Gas Turbine Stations Complete First Winter's Remote Operation

☐ Four new satellite stations on Texas Eastern's Penn-Jersey storage withdrawal line recently completed the first five months of unattended operation. Selection of giant single turbine units controlled from the next station 25 miles downstream cut station construction costs to $196 per hp. Operating economy looks promising, too, since the stations will see near capacity service on only about 90 of the coldest days of the year.

By Melvin A. Judah ..... Page 26

Slick Coatings Inside Small Diameter Pipe

☐ A laboratory investigation has shown that a high quality coating can reduce friction losses from 17 to 25 percent as compared with uncoated new pipe. Advantages for crude systems are greatest in the upper range of turbulent flow.

By Herman Levin and Morey Gephard ... Page 32

Five Ways to Supercharge Two-Cycle Engines

☐ Before you read this, try to think of five different ways this can be accomplished. If you do, chances are you'll come up with an idea or two that will surprise you. Magnolia Petroleum Company has used all five of these methods and all of them have advantages. Some are short term—like the idea of using electrical power to supercharge an engine to gain a temporary increase in horsepower.

By Robert G. Bolfing and Jerry F. Todd .. Page 37

How to Turn Your Automobile Into a Time Bomb

☐ Better read this one—it may save your life. Our so-called "safety cans" aren't safe at all; at least not for hauling extra gasoline in your automobile. The best way to turn a company auto into a time bomb is to fill a "safety can" with gasoline; store it in the trunk of your car on a hot day, and press the transmitter button on the radio that starts the generator in the trunk! ..... Page 42

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When is a public utility not a public utility?

Another example of the federal government's utter disregard of business logic and free enterprise was written into history on April 6.

On that date, FPC Examiner Joseph Zwerdling ruled that Phillips Petroleum Company should have a flat 9¼ percent rate of return, compared with the 18 percent requested by the company. Phillips' computed uniform price based on cost of 18.79 cents per thousand cubic feet was cut to 11.662 cents.

The public utility pattern in its most extreme form also was carried over to prices. Contract prices were wiped out, to be replaced by a single uniform rate schedule. Arm's-length bargaining for future sales was eliminated. Future sales must be made at the uniform rate.

In short, natural gas producers now are public utilities in every sense of Examiner Zwerdling's 343-page decision. This raises a question that should be taken all the way to the Supreme Court, if necessary:

How can natural gas producers be controlled as public utilities when they are not public utilities?

One major test of a public utility is the amount of competition an industry, company or group of companies has. If there is little or no competition, federal control is adopted to protect the consumer.

But no group is any more competitive than natural gas producers. FPC estimates there are more than 5,000 different operators producing gas in the United States. Considering lease partnerships and those not selling in interstate markets, reliable sources place the total number of producers at 8,000.

The natural gas producer is given no exclusive area in which to develop natural gas supplies. He competes vigorously with all other producers seeking reserves. He is not assured a geographically exclusive market for his output. He is afforded no public license of a balance of supply and demand at a price that will afford him a fair return on investment, other than that estimated by public officials.

There is no consistent relationship between capital investment and amount of production. The risk element of the oil and gas industry is well known to be extremely hazardous.

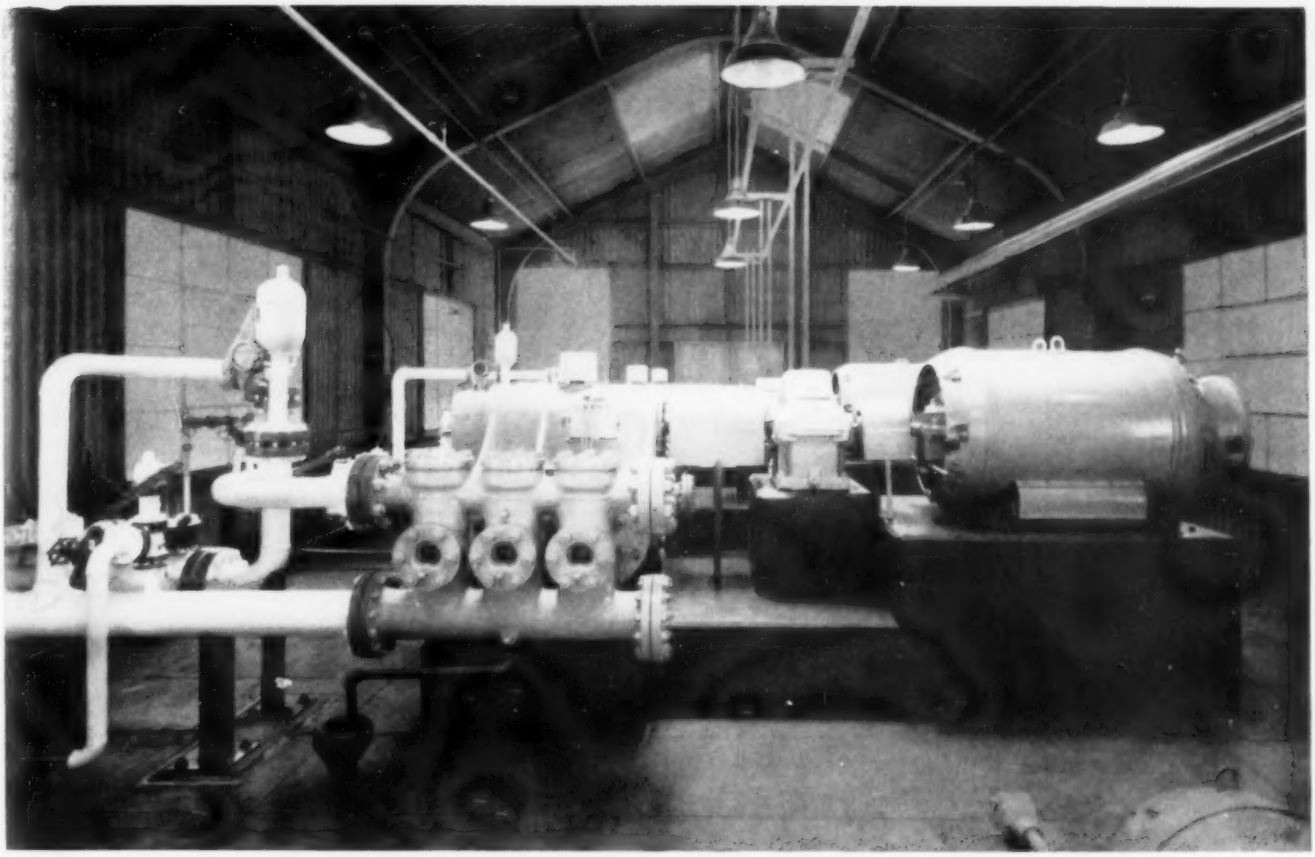
If such a ruling as the Phillips Decision can be made in complete disregard of these factors, what is to stop the federal government from taking over oil, and all industry for that matter? What is to prevent full government control of industry, with prices and profits dictated—with public officials determining what it costs to put a product on the market?

History has proved that government will not stop of its own accord. Only concerted effort on the part of industry and the public can stop the ever-growing, incentive-killing, stifling power of federal control.

There still is time to do something about the Phillips Decision. There will be hearings before the FPC, and possibly appeals to higher courts. Through the highest form of statesmanship, the case for free enterprise must be laid before the public. Oil company stockholders, employes, and the general public must be made to understand what they stand to lose if U.S. industry is shoved completely under the thumb of government controls.

However, it will not be enough to merely plead the natural gas producers' case. A logical, workable plan to replace federal control also must be presented. Industry leaders might even offer such a "radical" solution as letting producers establish prices through open competitive bids to pipe lines, with the FPC policing the procedure.

No matter what the plan, an all-out effort must be made to keep industry free of government shackles.



They're pumping products to market with these "Oilwell" Triplex Plunger Pumps

IN THIS PUMPING STATION, three "Oilwell" Triplex 358-P Plunger Pumps take care of the round-the-clock assignment of moving LPG from the field processing plant in New Mexico to marketing terminals in Utah.

Their horizontal design with (1) large power-end access covers, (2) outside access for bearing adjustments, (3) crosshead shoes, (4) two-piece plungers, (5) removable stuffing boxes, (6) screw-type glands, (7) interchangeable individually removable valves and (8) individual cylinder heads and valve covers; requires minimum attention and simplifies maintenance.

The 358-P fluid end accommodates a variety of plunger sizes and provides pressure-capacity selections covering a wide range of pumping requirements. The 368-P fluid end, which is fully interchangeable, extends capacities at reduced pressures.

USS and "Oilwell" are registered trademarks

Bring your pumping problems to "Oilwell" and let experienced sales engineers recommend the type and size pump to meet your exact requirements.

PERFORMANCE DATA

Plunger Size, Inches	Maximum Working Pressure (psi)	Normal Displacement Range Barrels per 24 hours at pump speeds (rpm) of:				
		100	125	150	175	200
358-P						
3¼	2,410	2,950	3,680	4,430	5,160	5,890
3½	2,080	3,430	4,290	5,145	6,000	6,850
4	1,590	4,460	5,550	6,680	7,800	8,900
4½	1,260	5,655	7,060	8,460	9,900	11,300
5	1,020	7,000	8,740	10,500	12,230	13,970
368-P						
5½	840	8,435	10,540	12,650	14,750	16,840
6	710	10,075	12,590	15,100	17,630	20,600
6½	600	11,825	14,800	17,750	20,700	23,600
Brake Horsepower Required		133	166	200	232	266

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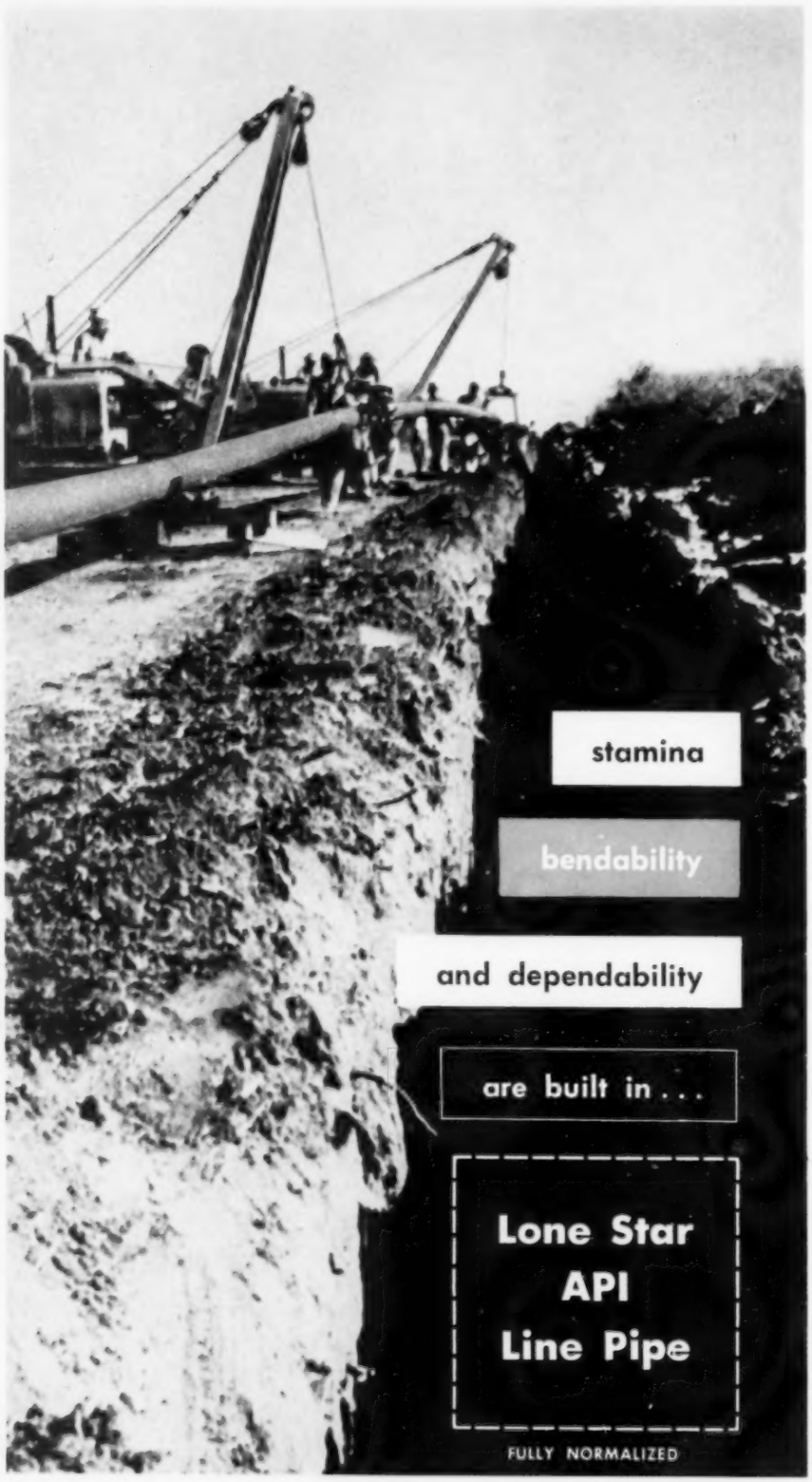
For more data on advertised products, use Readers' Service Cards, last page.



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WORLD OIL and THE COMPOSITE CATALOG for the drilling-producing industry.

PETROLEUM REFINER and THE REFINERY CATALOG for the oil, gas and petrochemical processing industry.

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Indexed by Engineering Index

Careful supervision of a wide geographical area over 100 miles in length is the watchword at Long Island Lighting Co.

The Long Island Lighting Co., a combination company, strives to maintain a 100% Load Factor, on purchased gas. Naturally, to avoid contract penalties the load variation requires careful supervision of the gas distribution system.

Only one dispatcher per shift controls the distribution system—24 hours a day, 7 days a week. Bristol telemeters put continuous status information at the dispatcher's finger tips: individual flows, pressure of gas at gate stations, amount of gas purchased at gate stations as well as status of the distribution system with pressures telemetered from important points on the Island.

Long Island Lighting anticipates that their gas load will more than double by 1962 and their Bristol instrumentation is flexible enough to take this increased demand in its stride.

Why not find out what Bristol telemetering can do for you? Better pressure regulation during unexpected demand periods, avoidance of contract penalties, security against interruption to service from abnormal conditions are just a few of the benefits you can expect. Distances can be anything from "in-plant" to hundreds of miles. Write: The Bristol Company, 114 Bristol Road, Waterbury 20, Conn.

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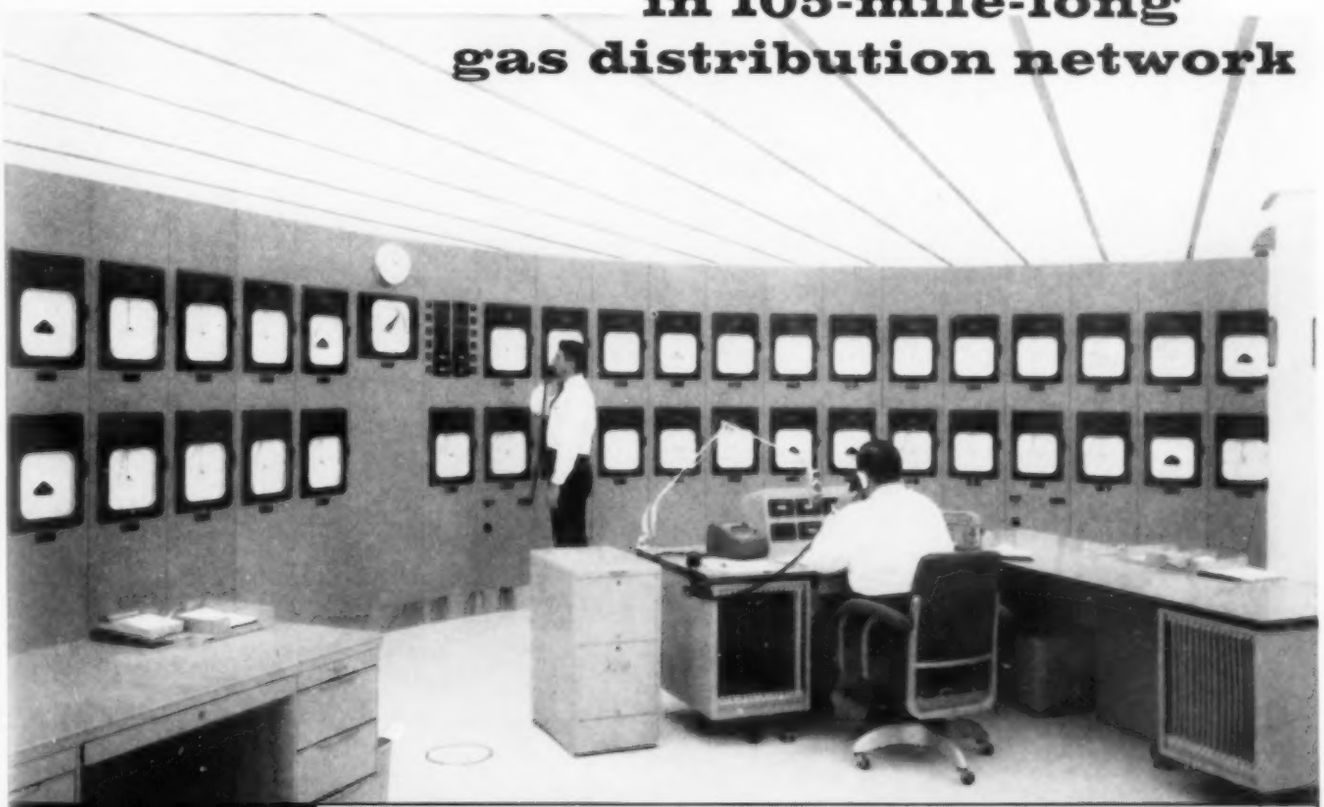
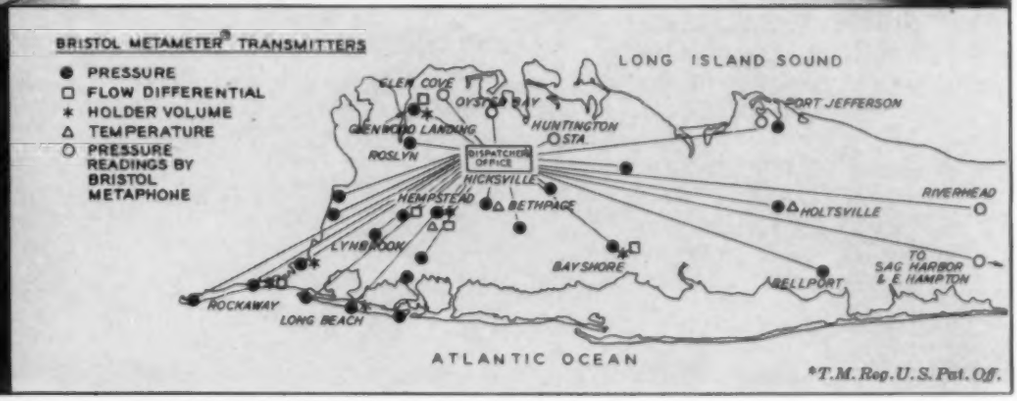
BRISTOL TELEMETERING helps maintain load in 105-mile-long gas distribution network



Bristol Metameter* Receivers on gas dispatcher's panel at Long Island Lighting Company's Hicksville, N. Y. Operations Center. These recording instruments make possible precision operation of a distribution network over 100 miles in length (see map).



*T.M. Reg. U.S. Pat. Off.

BRISTOL *TRAIL-BLAZERS IN PROCESS AUTOMATION*
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

For more data on advertised products, use Readers' Service Cards, last page.

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Humble MULTI-PURPOSE GREASE H is a superior lubricant for chassis, track rollers, wheel bearings, water pumps, ball and roller bearings and universal joints. MULTI-PURPOSE GREASE H matches or exceeds the quality of every single-purpose grease it replaces. It's not affected by heat or water. And it maintains its consistency. This means it is easily applied even on cold days, and it gives sure lubrication summer or winter.

HUMBLE OIL & REFINING COMPANY

1 2 3 4 5 6 7 8 9 0

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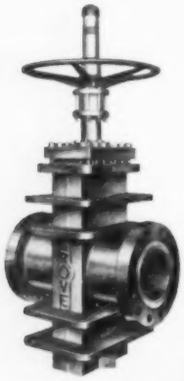

This is a rugged, dependable valve you can forget until you really need it. When you do—it'll work. There's no wedging to cause wear and jamming. The polished gate slides easily and quickly between smooth metal seats and rugged "O" rings. Exclusive Grove design lets gate and seats float free—eliminates distorting effects of pipe-line strain, internal pressure and temperature. Requires as many as 250 less turns to close than some competitive valves, too.

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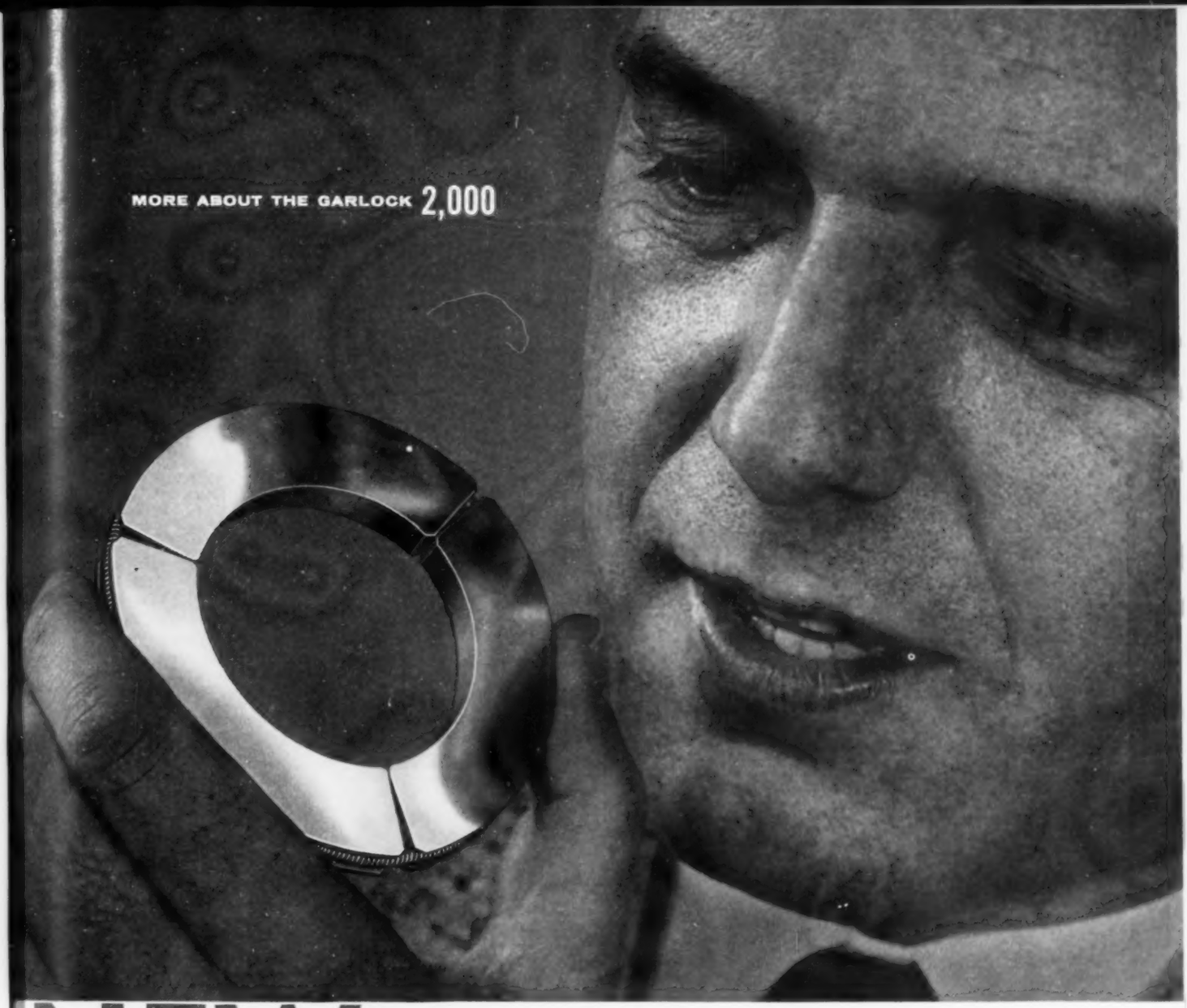

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Now all Garlock Metal Scraper and Packing Rings have a surface finish of 10 micro-inches or less! And flatness of the rings is measurable in light bands; which means a more positive seal between ring and groove. This exclusive Garlock advantage has been made possible through improved manufacturing technique and is offered to you without additional cost.

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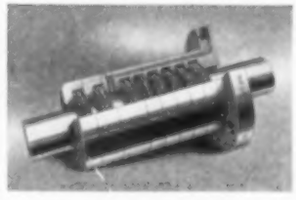

Garlock Metal Packing Rings of graphitic cast iron, bronze, carbon, bakelite and babbit are precision made to exact specifications of size and finish assuring maximum efficiency.

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nature is not enough

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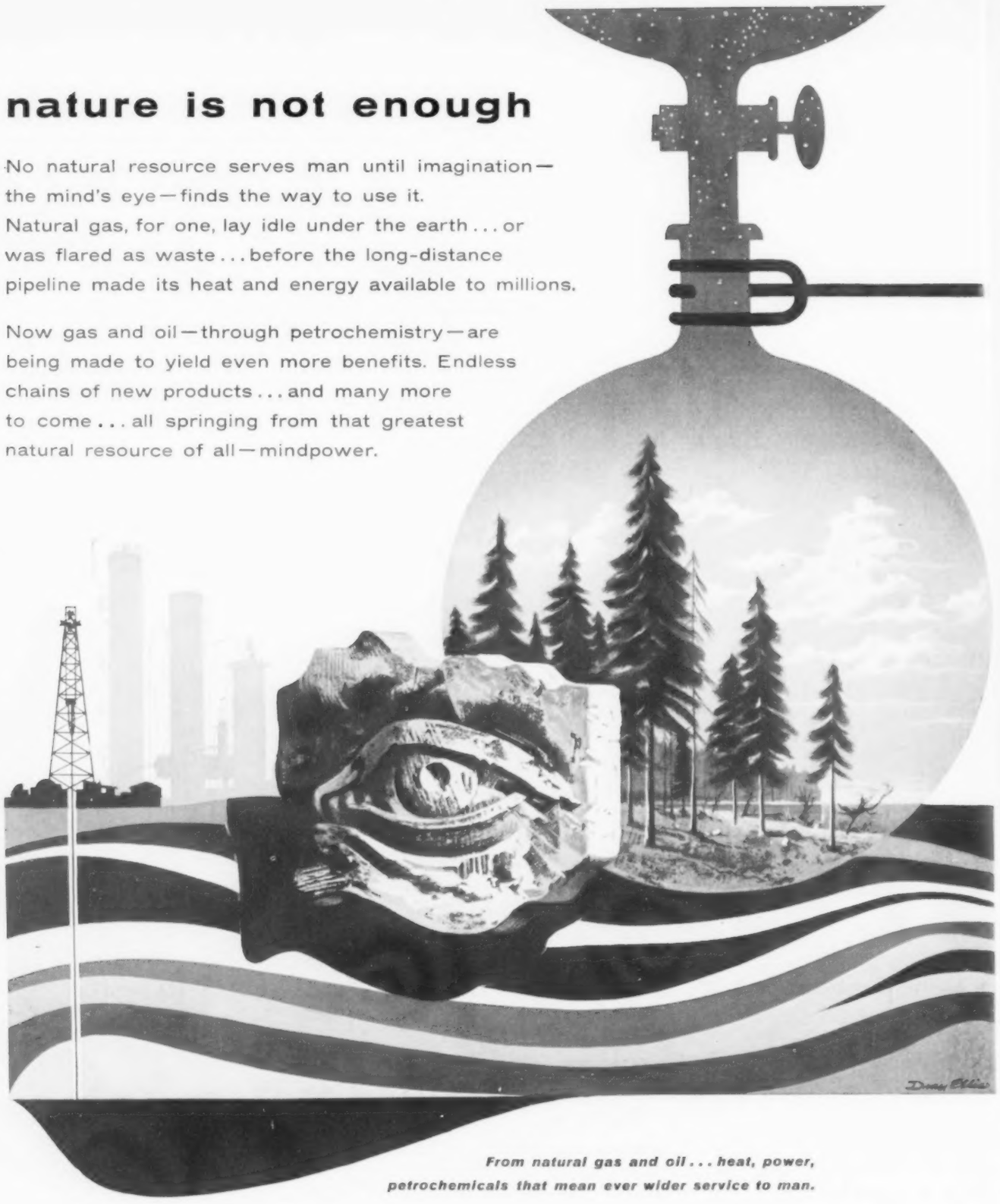

From natural gas and oil . . . heat, power, petrochemicals that mean ever wider service to man.

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LEADING PROVIDER OF ENERGY—NATURAL GAS, OIL AND THEIR PRODUCTS

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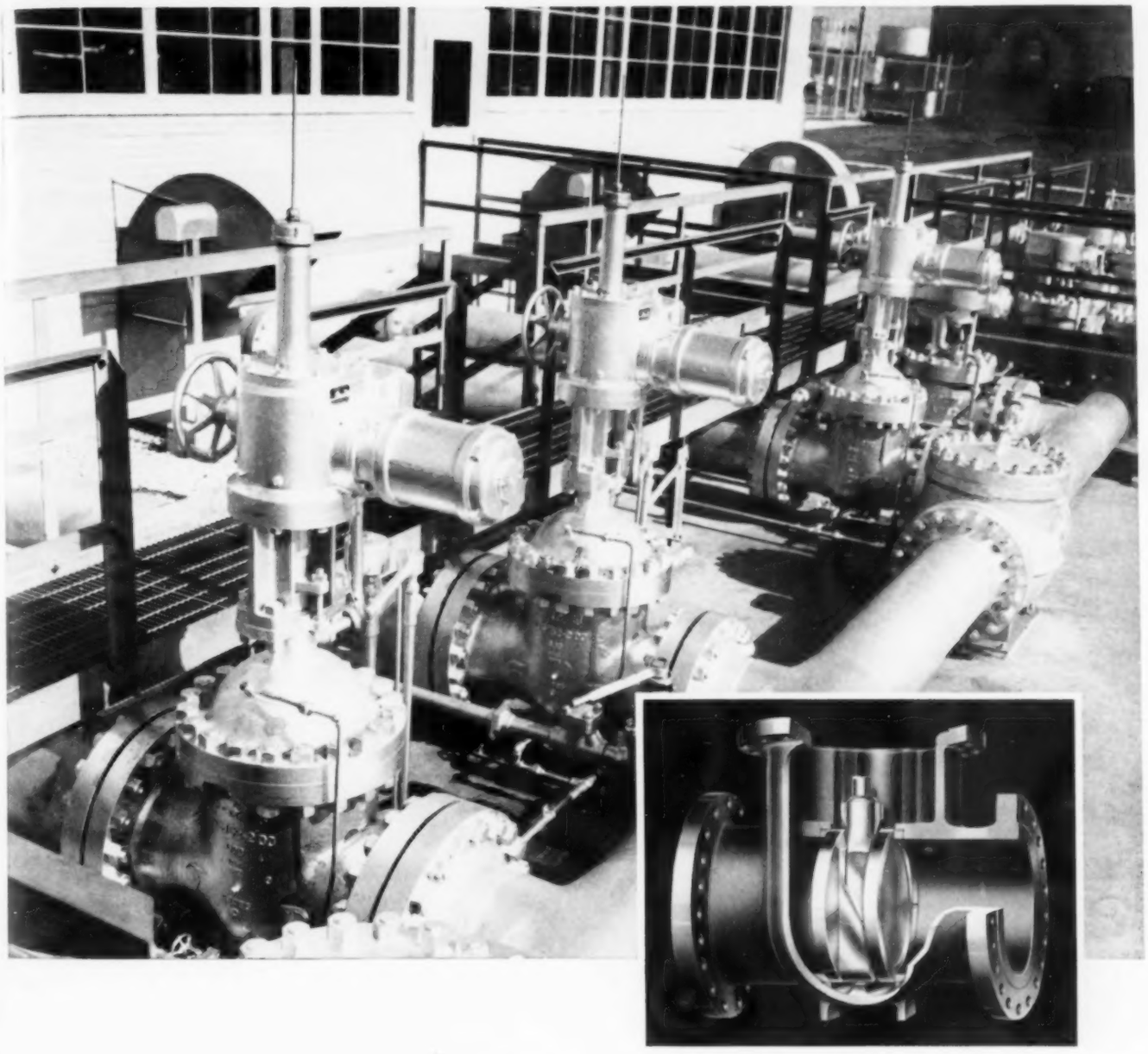

Why Darling revolving double disc gate valves mean . . .

permanent good behavior!

THE reason is very simple. These valves are different! They were designed with one objective uppermost—to be uneffected by the very conditions that lead to trouble in ordinary gate valves. And so it was that Darling came up with the fully revolving double disc, parallel seat principle. It minimizes friction and avoids wear concentration. It assures remarkably easy operation with self adjustment for positive closure. It automatically compensates for any valve body deflection.

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'59 Ford Pickups beat average mileage of other leading makes by 25.2% in Economy Showdown U.S.A.

Here at last is certified proof of the differences in gas mileage between six-cylinder pickups . . . evidence that you can use in your operation.

It was compiled by America's foremost independent automotive research firm after testing 1959 six-cylinder, ½-ton pickups of the six leading makes. All trucks were bought from dealers—just as you would.

The tests paralleled every kind of driving – high speeds and low, open highways and city traffic, even door-to-door delivery. And in every test, '59 Ford Sixes delivered more miles per gallon than any other make. Here are the actual percentages:

HOW NEW '59 SIXES RATE IN GAS MILEAGE						
'59 FORD SIXES GIVE	25.2% more miles per gallon than Make "C"	31.1% more miles per gallon than Make "I"	9.6% more miles per gallon than Make "G"	42.6% more miles per gallon than Make "D"	22.0% more miles per gallon than Make "S"	25.2% more miles per gallon than the average of all makes

Taken together, Ford got 25.2% more miles per gallon than the average of all other leading pickups!

What's the secret of Ford's economy? First, of all pickup sixes, only the Ford Six has modern Short Stroke design which reduces engine friction and thus requires less fuel. Second, to this modern engine, Ford has added a new economy carburetor to meter fuel more precisely in both high- and low-speed ranges.

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says:

"We've had less downtime with Ford Trucks than with any other make we've used!"

"We service oil wells all over the state of Michigan, plus the northern parts of Ohio and Indiana and I don't think there's a tougher truck operation. Our Ford Trucks are always on the job and most of the jobs take us a long way off the road—in fact we frequently have to make our own roads.

Visit

THE FORD TRUCK EXHIBIT

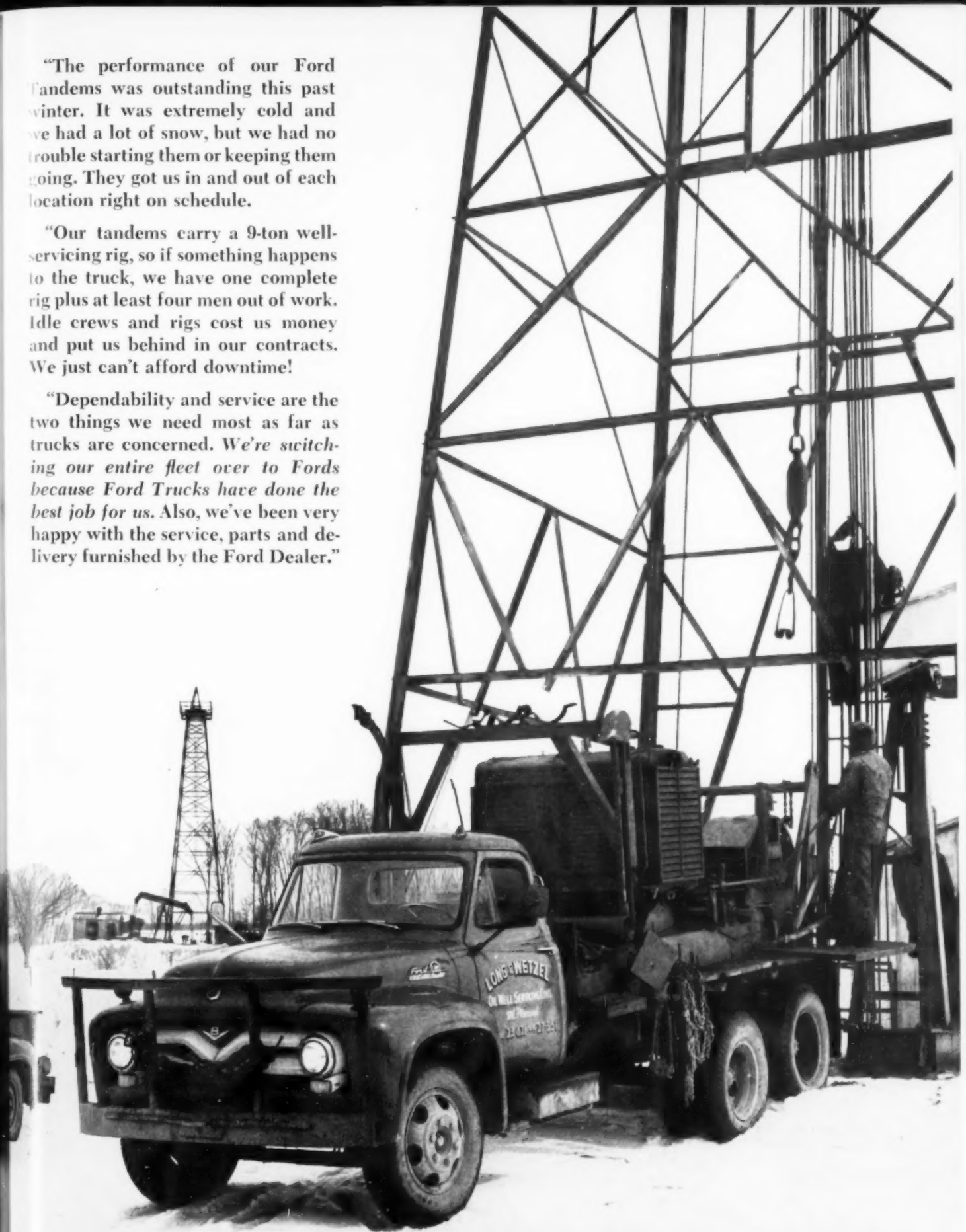
International Petroleum Exposition
Fairgrounds, Booth 6E, Tulsa, Oklahoma

MAY 14-23

"The performance of our Ford Tandems was outstanding this past winter. It was extremely cold and we had a lot of snow, but we had no trouble starting them or keeping them going. They got us in and out of each location right on schedule.

"Our tandems carry a 9-ton well-servicing rig, so if something happens to the truck, we have one complete rig plus at least four men out of work. Idle crews and rigs cost us money and put us behind in our contracts. We just can't afford downtime!

"Dependability and service are the two things we need most as far as trucks are concerned. *We're switching our entire fleet over to Fords because Ford Trucks have done the best job for us.* Also, we've been very happy with the service, parts and delivery furnished by the Ford Dealer."



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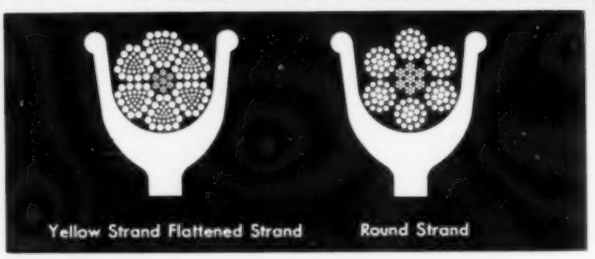


HOW

Houston Contracting Company

CUTS WIRE ROPE COSTS 50% ON TOUGH BACKFILL JOB

This was a tough one. Wide ditch – heavy, wet dirt – high line speeds over a short distance – severe reverse rope bend – an extra large bucket. Rapid wear and fatigue actually tore apart ordinary round strand rope to the tune of five to seven 50′ lengths per day. Then Houston Contracting Company selected Yellow Strand Flattened Strand Wire Rope. Now, one length per day is used in place of five to seven. They cut rope costs by 50%, saved substantially in man-hours and machine down time.

What made the difference? Compare the two illustrations above: See how each strand of Yellow Strand Flattened Strand is laid up in a triangular pattern. Contact with the sheave groove is made by *many* wires instead of just a few. Note the marked increase in compactness in the Flattened Strand, with greater crush resistance and 10% greater metallic area. This is the design that makes ropes, sheaves and drums last longer! For complete details about Yellow Strand Flattened Strand, contact your distributor or check with us. Broderick & Bascom Rope Co., 4203 Union Blvd., St. Louis 15, Mo.

Yellow Strand®

WIRE ROPE SLINGS CLIPS

PIPE LINE PANORAMA

Pipe Line Progress Featured at API Meeting . . . Latest methods and equipment for pipe line transportation will fill program at annual API Pipe Line Conference in Pittsburgh, May 13-14. Some of the subjects to be covered:

- **Design Features of Laurel Products Line,** including: Use of variable size pumping units—automatic and central control systems that reduce attendance cost to a minimum—ultra-modern communications system for telemetering and supervisory control.
- **Research and Development in Pipelining** reveals interesting fact that between 1953 and 1957 pipe line operating costs increased 18 percent to $293.4 million, volume increased 28 percent, unit costs decreased 8.8 percent to 2.48¢/bbl/100 miles, and average number of employes dropped 10 percent to 24,313. Major technical "needs" for the future: Completely automatic pipe welding process—automated meter calibration systems which will produce an accurate meter factor quickly and directly without computation—centrifugal pumps designed specifically for viscous fluids.
- **Design Considerations for Minimizing Contamination** describes how tankage, manifolds, stations, and auxiliary equipment can be designed to minimize contamination loss resulting from mixing of miscible liquids pumped adjacent to each other—particularly in short lines involving few stations.
- **Study of Continuous Pressure Traverses** presents results of test program and examples to show how pressure traverses can be conducted on routine basis, and that methods for continuous internal surveying of pipe lines for variety of operating or equipment conditions are feasible.

Latest in Industry Trend to Automation . . . Texas Eastern's Bernville, Pennsylvania compressor station, one of four identical units added to company's 6,100-mile natural gas pipe line system in '58, marks important industry firsts (See Page 26):

- Designed to operate during unusually heavy load periods, Bernville station moves gas with two-stage centrifugal compressor powered by 13,400 hp gas turbine—largest ever applied to gas transmission operations.
- First large scale use of synthetic fire resistant lubricant. **Station has full remote control operation.** Recording equipment at Bernville can tell operator at Bechtelsville 30 miles away whether station building contains hazardous atmosphere, or whether unauthorized visitor has entered station. By centralizing large horsepower in single unit, station was built at relatively low initial cost of $196 per horsepower.

1958 Gas Sales Up 3.7 Percent . . . Gas utility and pipe line sales started 1959 at a blistering pace, totaling 10,017 million therms—13.8 percent higher than January, 1958. February sales: 9,373 million therms, 2.1 percent over same '58 period.

During 1958, gas sales increased 3.7 percent over previous 12-month period, according to recent A.G.A. report. 1958 total: 80,606 million therms.

Dallas AGA Meeting to Be Highly Informative . . . Members of the AGA Operating Section, Gas Supply Transmission and Storage Conference will meet in Dallas' Statler-Hilton May 18-19 for one of the top pipe line idea sessions of the year. Included will be such subjects as storage of gas in water sands; computer applications; underground storage; gas industry in France; constructing, testing and operating a Canadian natural gas pipe line system; internal pipe coating; progress in solar weather research; and offshore gas measurement. Also, there will be three compressor station panel sessions, including one on proven applications of compressor station automation.

Houston Texas' 20-inch main line gets wrap of polyethylene tape and is lowered into water-filled ditch west of Vero Beach. Construction progress was exceptional on this line. Marsh, sand and water was an ever-present problem.

Florida Line Brings New Construction And Operating Ideas in Pipelining

Despite disappearing ditches, shifting sand, mud, marsh and flooding waters, the Houston Texas gas line should be ready to deliver gas early next month

By Melvin A. Judah, Editor
Donald G. DePugh, Construction Editor, PIPE LINE INDUSTRY

BECAUSE OF the new ideas introduced on the Houston Texas Gas and Oil Corporation line that runs from Baton Rouge, La., to Miami, Fla., pipeliners everywhere will be watching its performance for the next few years. Engineers and contractors scored several unconventional "firsts." Here are some of the important ones:

1. Mill double jointing was used extensively on the main line.

2. For the first time, polyethylene tape was used to coat an entire major gas transmission line.

3. A variety of expedient construction methods were used to cross marshes and rivers.

4. Yard-fabricated, tilt-up erection, clear span bridges were used on major river crossings.

5. Concrete coated pipe, river weights, screw-down anchors and quick backfilling—all were used to keep the pipe from floating in the ever-present water filled ditches.

There were new developments in compressor stations, too. The most important one was the new separately mounted compressor units. At the stations, three 2,000 hp super-charged compressor engines drive pancake compressors. Each engine features unitized design. *Engine cooling water powers cooling fan drives,* eliminat-

Welding machines for stringer beads and hot passes were mounted on steel scows to get through marsh and water country. Scows could float across small streams and bodies of swamp water, and their tracks permitted good progress in mud.

(Above) Ditch was made by wheel type ditchers, draglines, or backhoes as the terrain required. Wet sloughing sand was a problem in many areas. Special slopers were used to widen the ditch with cut backs as much as 12 feet for 6-foot ditch in some areas. In southern Florida where coral deposits deposits were encountered, ditcher teeth and side cutters had to be changed frequently.

(Left) To speed communications on John Work's Midwestern-Walco spread in north Florida, two-way radios were installed on tractors. This one was with the coating and wrapping gang.

ing the the need for a separate hydraulic system. Oil filters, auxiliary piping, air tanks, dehydrators and other engine auxiliaries have been installed on pads outside the station building, thus simplifying maintenace and providing more clear work space around engines and compressors.

Construction schedules call for completion of the line in time to start deliveries of gas by June 1. Coastal Transmission Corporation, another subsidiary of the Houston Corporation, is completing the Texas and western Louisiana main line and gathering system.

Line Design. Houston's 914-mile main line has 680 miles of 24-inch, 99 miles of 20-inch and 135 miles of 18-inch pipe. In addition, there are more than 705 miles of laterals ranging from 2 to 18 inches in diameter. Specifications call for API 5 LX Grade X-52 pipe with 0.312-inch wall thickness for most of the cross-country 24-inch line. Where population density is high, the wall thickness is beefed up to 0.375-inch wall thickness. The same increase in thickness was used at the many road crossings. Major river crossings were made with 0.438 or 0.500-inch wall pipe.

On this Midwestern-Walco spread in northern Florida, draglines backfill ditch directly behind the cleaning and wrapping machine. Special precautions were taken to make sure that the ditch was free of roots on the side of the ditch in timber country. Where high water tables were encountered, ditch was backfilled quickly with wet sand to provide a hold down.

Close up of cleaning and wrapping machine shows how pipe was brush-cleaned and wrapped in one operation. Air blowers directed the dust cloud away from the tape rolls.

Mill Double Jointing Cuts Welding One-Third. Double jointing 30-foot lengths of pipe reduced line-up and field welds by one third. This, in effect, gave contractors 60-foot joints of pipe to work with rather than the conventional 40-foot joints.

Savings on Welding. Houston's engineering department estimated that use of 60-foot lengths of pipe saved more than 15 percent of the cost of welding as compared with conventional 40-foot joints. Actually, there were more welds where 60-foot joints were used, because of the basic 30-foot joint length, but because half of them were made automatically at the pipe mill, the average cost was considerably less.

In addition to requiring a third fewer welds, the 60-foot length also required a third fewer line-ups etc., and the extra 20 feet originated few, in any, difficulties. Considering the terrain, the sand, mud and water construction progress was exceptional.

For example, Supt. John Work's Midwestern-Walco spread made unusually good progress across northern Florida. On several occasions, this spread laid better than 3½ miles of line a day. The average speed for the spread's entire job was above two miles per day.

Construction Practices. On this particular spread, three stringer-bead welders, four hot-pass welders and nine firing-line welders were used. Welding machines for stringer beads and hot passes were mounted on steel scows as an answer to the difficulties of the Florida right-of way which varied from mud to sand to water. Scows could float across small streams and bodies of swamp water; their tracks enabled them to make excellent progress in mud and sand.

Ditching was done by wheel-type ditchers, drag lines and backhoes.

Special slopers were used on the wheel-type ditchers to give a six-foot-deep ditch a width of up to 12 feet at the top in sandy areas. Where stumps and rocks were encountered, back hoes were used. Backfilling was conventional—with draglines, bull-dozers, and backfillers.

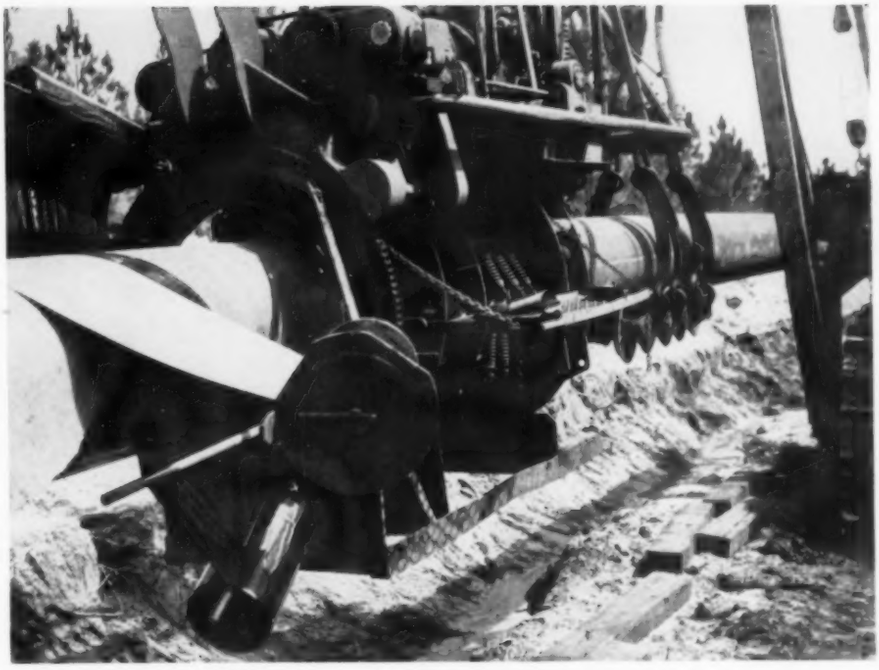
X-Rays. More than 60 percent of the welds were X-rayed. All of the double jointing welds at the mill were X-rayed and 30 percent of the welds made on the line. Field X-rays were made with Iridium 192 isotope; this source emits a gamma ray of a low frequency which gave an excellent picture of the critical stringer-bead.

Polyethylene Coating. As mentioned above, this is the first major transmission line to be coated entirely with tape coating. Using no primer, all of the main line was wrapped with 14-mil-thick polyethylene tape covered with a 15-pound asbestos felt outer wrap. Purpose of the latter is to protect the line from roots, rocks and scraping during lowering-in.

Houston engineering vice president Paul Herzig pointed out that in many cases, use of the tape helped contractors meet special construction problems. In marsh, and wet sand areas, the pipe was wrapped and lowered-in immediately after the ditch was opened. This was possible because any necessity for cooling and setting of the coating was eliminated.

There are a number of other advantages claimed for the tape. By bringing lowering-in right up to the coating machine, exposure to bad weather is minimized. Progress made by the coating crews was excellent, and kept them on the heels of the welders much of the time. In an average day, coating crews could wrap about 15,000 to 20,000 feet of pipe; top production for one crew has been found to be about 25,000 feet.

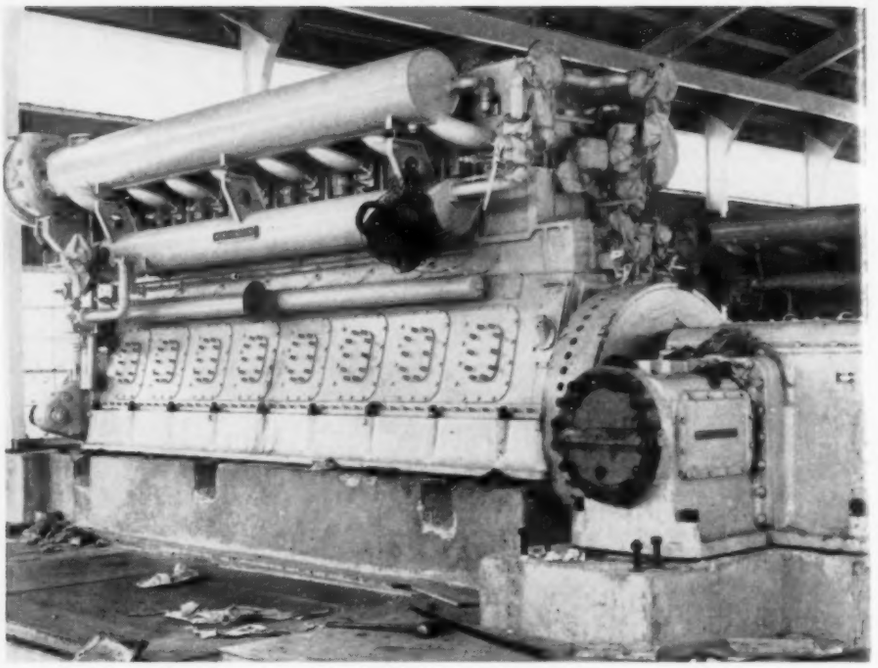
Houston engineers report that feasibility studies showed that three main line spreads saved about $500 per mile through use of the tape. According to this study, the higher cost of tape materials was offset by application savings. The savings in application that come from reduced equipment and labor on the line is estimated at 25 cents per foot or $1,310 per mile. Total material cost for a conventional system would be about $2,351 per mile. Material cost for the tape and felt was estimated at $3,149 per mile or $798 more than the cost of conventional materials. Subtract this amount from the savings in application costs and the cost reduction realized runs about $512 per mile. However, it should be pointed out that if a glass wrap were omitted in the conventional system, savings would still be about $100 per mile for the tape application.



Tape wrapping head has spreader bar which smooths out wrinkles as tape is unrolled. Tension is controlled to maintain as smooth a tape surface on the pipe as possible.

Hot pass welders on north Florida spread make good progress. Use of 60-foot mill double jointed pipe cut field welds by one third saving on welding costs and speeding construction progress.

Pearson Survey of the Buried Line. To determine the initial quality of the coating material on the pipe after it was backfilled, Houston Texas Gas and Oil retained a corrosion engineering consultant to make three Pearson holiday surveys of the line. These surveys covered the first 100 miles of the pipe in the ground east of Baton Rouge. A survey between the Pascagoula River and the Mobile



(Above) Supercharged 2,000 hp, 4-cycle engines drive pancake type compressors in Houston's four main line compressor stations. Compressors have two 15½ by 15-inch cylinders with four steps of unloading. Unitized design is featured in all of these stations. Engine design was specified on the basis of fuel economy.

(Left) Within two miles on this central Florida spread three different methods were used to hold down pipe. Here screw-type anchors are installed with an air tool to hold the 20-inch taped and wrapped pipe in the ditch. Rock shield was placed beneath the hold down clamps. Just upstream pipe was backfilled quickly with wet sand as a hold down. About a mile downstream concrete coated pipe was used where sandy soil turned to marsh.

River in Alabama showed an average of 21 holidays per mile. No shorts were found between the line and road casings. Much of the line runs through swampy cypress marsh ground containing a high content of decayed vegetable matter. Coating resistance in such areas was found to be in excess of 1 million ohms per square foot.

Another survey covering 35 miles of 24-inch line between Baton Rouge and the Tangipahoa River in Louisiana disclosed only eight holdays per mile. Coating resistance was of the same order as in the first test, and no shorted casings were detected.

A survey of 38 miles extending east from the Choctawatchee River in northwestern Florida disclosed an average of 10 holidays per mile and one shorted casing. Coating resistance on this line was according to the report "considerably over 1 million ohms per square foot."

Herzig emphasized that a repeat of this survey is planned after the coating has been in the ground for a year.

Turnpike Construction. In south Florida, right-of-way acquisition problems were solved, as were a number of construction problems, by laying the pipe line alongside the Sunshine State Parkway between Fort Pierce and Miami, a distance of 130 miles. On the "sunny" side of the picture from the contractor's point of view—there was no right-of-way to clear, no access roads to grade and no fences and livestock to worry with. On the other side of the picture there were problems, and many of them.

Harbert Construction Co. was the successful bidder on this unusual section of line, and spread man Ray Abney can point out a number of disadvantages that arose to mar this seemingly easy going right-of-way. First, room along the parkway was limited. Equipment shifts were strictly controlled and could be made only by turnpike authority equipment. To complicate things in several areas, turn-arounds and access roads were widely spaced and in some instances, their use was limited.

Although most of the work along the parkway encountered sandy, high-water-table soil, there were occasional coral deposits. Because no blasting was allowed, the latter had to be cut by ditching machine; bucket teeth and side cutters had to be replaced often. Also there was flowing sugar sand. Where this occurred, it was often necessary to dig ditches 10 to 12 feet wide at depths ranging down to 5 feet to keep them from caving in before the pipe could be laid.

This was an 18-inch strung in 50-foot random joints. To combat problems inherent in high water table land, the welding operations were spaced about three miles ahead of coating and ditching. The latter were as close together as possible, and lowering-in was right behind. Progress on the turnpike section, completed early this year averaged about 8,000 feet per day—and on occasions nearly three miles!

River Crossings. A variety of methods was used on rivers and water areas on the Florida line. The 4,000-ft. St. John's river crossing south of

Kissimmee was made in a shove from the west bank. Five of the 25 major crossings were completed with clear span aerial crossings. Lengths of these major crossings ran as follows—

- 520-foot span over Pearl River,
- 640-foot span over Escambia River,
- 660-foot crossings of Pascagoula and historic Suwannee, and
- 960-foot aerial span over the Apalachicola River.

The box girder sections of the bridges were yard fabricated in Houston and bridge assemblies were then completed on the river banks. Crossings were erected by tilting the three-legged towers to vertical position hoisting pipe, suspenders and main cables to proper elevations.

So far as construction was concerned, the first step was to excavate and pour the footings for the towers. Each tower was then assembled in prone position on the river bank. Next, the line pipe was welded up on one bank, and the entire cable system was harnessed to it. Pipe was then floated across the river, and the terminal of the main cable was connected to the tower head on the far side. After the main cable was connected to both tower heads, towers were winched erect and the rear leg of each tower welded to foundation. Erection takes from 4 to 8 hours.

Engineers encountered "loose" sand in some of the station yards. A testing laboratory cored soil to 30-foot depths. Where load curves showed it was necessary, yards were stabilized by a vibrator roller before concrete pads and yard piping were constructed.

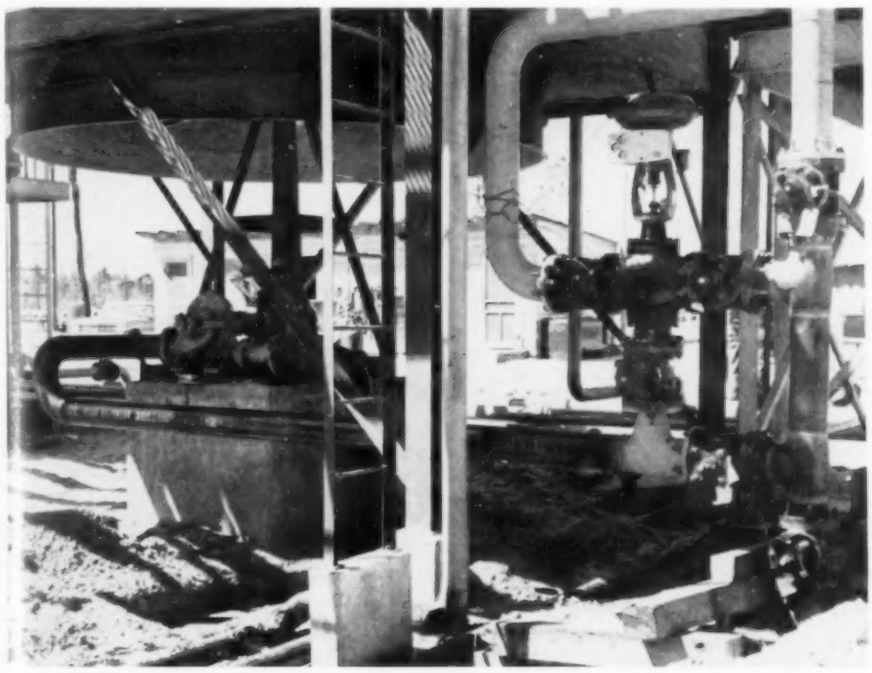
Cables are designed for direct lateral support of wind loads in excess of hurricane velocity.

Testing and Drying the Line. The Baton Rouge to Miami main line was hydrostatically tested throughout to 1,170 psi. Afterwards, water was purged from the line using inflatable neoprene rubber spheres, and test sections were then dried with a slug of methanol contained between two or four spheres. Sufficient volume of the methyl alcohol is run in the line to dry it out to a 50 percent recovered solution.

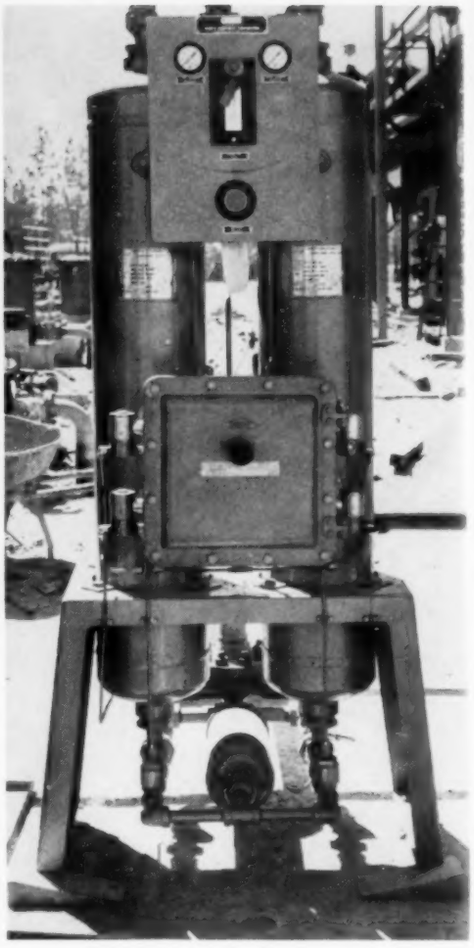
Stations Designed for Economy, Simplicity. Unitized design is an important feature of all four of the original compressor stations built on the Baton Rouge-Miami line. All auxiliaries will be driven off individual compressor engines. Jacket cooling water transmits the power to drive fans for the finned-tube water and oil exchangers. Supercharged 2,000 horsepower, four cycle engines, rated at 6,200—6,500 Btu per horsepower-hour drive pancake type compressors directly. This engine design was selected because of its fuel gas economy.

Stations at Quincy and Worthington Springs, Fla., will be equipped initially with three engine driven compressors having two 15½ by 15-inch cylinders, with four steps of unloading. Similar units are installed in stations at Wiggins, Miss., and Munson, Fla.

Cooling-Water Powered Fans. The hydraulic water drive incorporated in all of the Houston stations is a new wrinkle in compressor design. A single-stage centrifugal, jacket water pump circulates 600 gallons of cooling water per minute. Power

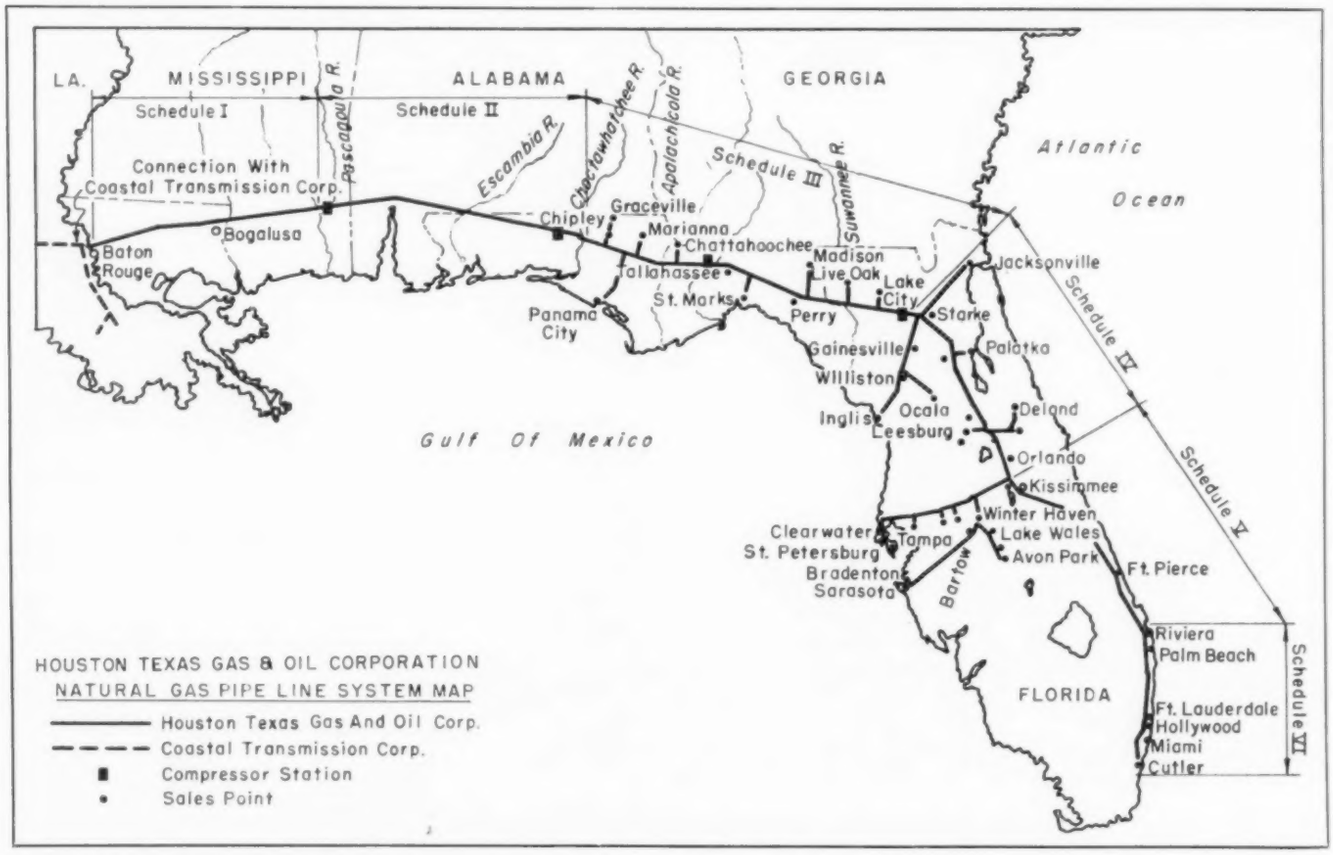


A hydraulic water drive is used to power cooling fans for jacket water and lube oil. Jacket water leaves the engine at about 180°F. A 6-inch butterfly valve in piping loop controls water bleed off to the fan turbine. Precise temperature control is maintained by controllers on both the jacket water and lube oil banks. Approximately 40 hp is consumed in water circulation and fan drive.



(Above) Oil filters, air dehydrators, and other auxiliaries are located adjacent to the main station building. Moving appurtences outside provides extra room around compressors to simplify maintenance and overhaul.

(Right) Twin air dryers permit continuous dehydration of compressed air supply. Dryers are installed between the two receivers.



Route of the Houston Texas main line from Baton Rouge to Cutler, Florida. Construction was completed in six schedules. It will connect with Coastal Transmission's line at Baton Rouge. Scheduled deliveries are set for June 1.

transmitted by the jacket water drives the fans cooling both the water and lube oil.

Jacket water leaves the engine at about 180° F. A 6-inch butterfly valve in the jacket water piping loop controls the amount of water bled off to the fan turbine, and thus controls cooling. Precise control is maintained by temperature controllers for the jacket water and lube oil tube banks.

Approximately 40 horsepower is consumed in the circulation of cooling water and fan drive. Design engineers point out important reasons for this design; It eliminates a duplicate set of "power" piping for the hydraulic oil and use of hydraulic fluid; Less rigid internal cleaning demands during maintenance; Plus economy and simplicity in design.

An auxiliary cooling water pump circulates supercharger turbine cooling water through a cooling tower adjacent to the main cooling units. This tower is a small forced-draft, asbestos cement-sided tower of corrosion resistant design.

Outdoor Auxiliaries. Oil filters, air supply tanks and dehydrators, and other appurtenances are located just outside the main station building. This makes for a "roomy" station around compressors and engines; it provides more work space and should simplify maintenance and overhaul.

Compressed air for starting, instruments and pilot service is cooled by an overhead finned-tube bank upstream of the air dehydrators. Twin dryers located between the two air receivers permit continuous dehydration of the compressed air supply.

Sand-Hurricane Tight Stations. Main station buildings are of corrugated asbestos siding; large areas of translucent glass fiber reinforced polyester panels provide light in the station and seal against dust and sand. There are no "open-close" windows to permit entry of sand. All station structures are designed for hurricane wind loads.

Stabilizing Sand Around Yard. To overcome a special problem encountered in a north Florida station yard, design engineers had a testing laboratory core soil to 30 foot depths. Where load curves indicated it was needed, yard areas were stabilized by a vibrator-roller behind a bulldozer. This was done prior to pouring of concrete pads and installation of yard piping.

Attended Control. All of Houston Texas' stations have partial sequence control with provisions for possible future automatic operation. Controls provide maximum safety and reliability by monitoring operating conditions and initiating automatic shutdown when necessary.

Initially, however, all stations will be attended. Twelve men will be assigned to each station; personnel include a station chief, repairman-engineer, four operators, four assistants or oilers, and two yard maintenance men.

Houston will receive gas from Coastal at a pressure of 975 psi. Suction pressures at each of the stations will be between 650 and 700 psi with discharge pressures boosted to 975.

Electric power necessary for operation of engines is provided by the unitized design. Power is purchased for station lighting and personnel housing. A 100 kw packaged motor generator provides stand-by power for each station.

Communications for the Houston system will be by leased wire line, common carrier service. Dispatching will be handled from St. Petersburg, Fla., site of the company's headquarters.

Operating Plans. A large share of the initial capacity of the Florida line will meet industrial demands of Florida Power and Light Co. and Florida Power Corporation. These two companies have contracted directly with South Texas and Louisiana producers; some 150 million cubic feet per day will be transported by Houston on a cost of service basis.

Gas purchased by Houston Texas for resale to commercial and residential consumers will become an increasing load. Houston Corporation, the parent company of both Houston Texas and Coastal has purchased manufactured gas systems in Jacksonville, Orlando, Miami, Daytona Beach, plus several LPG systems in other cities. In addition, the company has contracts to supply other independent or municipal systems who will convert to natural gas. Plans call for Houston to spend over $23 million in the next three years to expand Florida distribution systems in the conversion to natural gas.

Future Expansion. Capacity of the original $103,980,300 system will be 282 million cubic feet a day. Plans have already been drawn up for expansion of daily capacity to 411 million cubic feet per day through addition of compressor horsepower and lateral lines costing $41 million. These additional facilities would be scheduled for completion in early 1960, contingent on FPC approval.

—The End

Contractors on the Houston Texas Line

Main line and laterals—Midwestern-Walco Constructors, a joint venture of Midwestern Constructors, Inc. and Walco Engineering and Construction Company; Harbert Construction Corp.; Mid-States Construction Company.

Compressor station design and Engineering—Barnard and Burk, Pipeline Engineering, Inc.

Underwater river crossings—Panama, Inc.

Overhead crossings—Clear Span Engineering Company

Hydrostatic testing—Walnesco, Inc. and Williams Pressure Service Company

Pipe stringing and stock piling—Parkhill Truck Company

Road crossings—Oklahoma Road Boring

Corrosion engineering and surveys—Cathodic Protection Service

Certifiying engineer—Commonwealth Services, Inc.

Next month Coastal Transmission Corp. PIPE LINE INDUSTRY'S June issue will have a complete design and construction story on the Coastal Transmission line from the Texas Rio Grande Valley to Baton Rouge which will deliver gas to Houston Texas Gas & Oil. Also to be covered in that special feature will be the men behind Houston Texas Gas & Oil Corporation, Coastal Transmission Corporation, and the parent company The Houston Corporation.

Texas Eastern's Bernville station on the Penn-Jersey Oakford storage line is one of four identical remotely controlled stations. Each is equipped with a single 13,400 horsepower gas turbine driving two-stage centrifugal compressor. In the first winter's peaking service they have proven new design concepts.

New 13,400-HP Turbine Units Remotely Operated

Four units on Texas Eastern's Penn-Jersey line are "satellites" controlled from stations 30 miles downstream. They have proven many engineering and economic "firsts"

By Melvin A. Judah, Editor
PIPE LINE INDUSTRY

A VISIT to one of Texas Eastern's four new giant remotely controlled turbine stations reminds one of the East Indian planter controlling elephants from his veranda with silk threads. For the Texas Eastern stations the "threads" are two-pair, wire circuits spanning 25 to 30 air line miles between the control station and the satellite; the "elephants" are the largest (13,400-hp) gas turbine centrifugal units ever used in gas transmission service. And Texas Eastern is controlling them precisely and economically.

Four of these identical stations are located in Pennsylvania on Texas Eastern Transmission Corporation's 24-inch Penn-Jersey pipe line. The line draws gas from the Oakford storage field and delivers it to Texas Eastern's delivery system at station 26 near Lambertville, N. J. These new stations recently completed the first five months of unattended operation. They are interspersed between four 15,000 horsepower gas turbine compressor stations each having three 5,000 horsepower gas turbine centrifugal compressor units.

The original stations are attended and serve as the control stations for the next satellite located upstream. Satellites located near Armagh, Entriken, Shermans Dale and Bernville are remotely controlled from Lilly, Grantville, Perulack and Bechtelsville respectively.

The primary reason for going to the large single unit prime mover was to provide high pipe line capacity economically for winter peaking deliveries. Normally the large satellites will run at or near capacity about 9 of the coldest days of the year. The will be off the line in summer; preventive maintenance, inspection and testing may be accomplished at that time. During these summer months the four 3-unit turbine stations may ride on the line; however only one or more units in operation provide very little compression.

Operating Flexibility. Combination of the large single turbine stations and intermediate three unit stations provide operating flexibility on the storage field peaking service line. It gives maximum throughput with all stations on the line and precise "vernier" control with the multiple unit stations.

Important new design features of the four new stations include:

1. Installation of the largest gas turbines used in natural gas transmission.

2. Simplified station design incorporating a maximum amount of fail-safe characteristics and inherent safeguards in the control system for the single shaft—simple cycle turbine.

3. Low initial cost resulting from large horsepower output with a single unit, plus lower construction costs from simplified station design.

4. Lower operating costs are expected to more than offset the additional cost of supervisory equipment for remote control and the monthly costs of communications channels.

5. To reduce fire hazards possible with natural petroleum lubricants, synthetic lubricant, a phosphate ester-based compound was used for turbine and compressor lubrication.

6. Control systems for the satellites are designed for sustained operation during short outage periods of purchased or auxiliary power.

7. Only one man tends the station; he is not required for its normal operation.

Economic Factors in Design. There is little doubt that in this particular service use of large horsepower single unit remotely controlled stations have definite economic merit. A breakdown of some of the actual costs are shown in Table 1.

Considering estimated cost of communications channels at approxi-

nately $5,000 to $10,000 per year for ach satellite-control link, plus labor osts economics are definitely in favor f the large single unit satellite for igh demand peaking capacity serv- ce. Costs shown in Table 1 for su- ervisory control equipment at Bern- ille does not include the sequencing, monitoring equipment, or other in- strumentation that would normally have been included in Texas Eastern's design for an attended turbine sta- tion.

Fuel demands for the large turbine units are reportedly about 10 to 20 percent higher; this is assuming heat load at rated conditions to be 12,250 Btu's per brake horsepower.

13,400 (Plus) HP Turbines. Prime movers for Texas Eastern's four new satellites are simple cycle, single shaft combustion gas turbines rated at 13,400 horsepower. Rating conditions are 4,860 rpm, 1,000 feet altitude and 80° F. ambient. Heat rate at these conditions is specified to be not greater than 12,250 Btu per brake horsepower hour (higher heating value); this corresponds to a thermal efficiency of 20.8 percent.

As ambient temperature is lowered, the gas turbine produces greater power; air density is increased as temperature drops and greater mass flow passes through the almost constant volume combustion air compressor. Power output increases in proportion to the increased air density. Turbines could deliver between 30 to 40 percent additional power over normal rating as ambients approach 0° F. This would mean that on the coldest peak days actual top horsepower output of the turbine theoretically could be as great as 18,760 horsepower.

Thermal efficiency also increases as ambients fall; with the possibility of increasing up to 7 points at extremely low temperatures.

Turbine auxiliaries include air silencer, expansion gas starting turbine, load coupling, lube oil system with tank and pumps, fuel gas system, ignition system, control panel, motor starter equipment, auxiliary switch gear, and distribution equipment. Other turbine accessories are mechanical-hydraulic governing system, starting and supervisory control equipment, vibration and high exhaust temperature shut down protective devices and flame detectors.

The turbine is split along its entire length at the horizontal center line; four top casing sections can be removed separately without taking the unit off its base or affecting line up. When the top half is removed all bearings are accessible for inspection and all rotating parts are removable without disturbing the lower half.

A fabricated steel base supports the gas turbine; it houses oil tank, piping, and integral wiring for the turbine. This 1,200-gallon oil tank is equipped with high and low level protective alarms.

TABLE 1

Bernville Station (Satellite) Cost

Cost of Station Not Including Remote Control Facilities	$ 2,561,794
Cost of One Cottage For Station Attendant	24,600
Bernville Supervisory Control and Communications Equipment (This includes supervisory panel, wiring, and installation service)	26,206
Control Station Equipment For Satellite Installed at Bechtelsville	26,700
Total Cost of Station	$ 2,639,300
Cost per Installed Horsepower	196.96

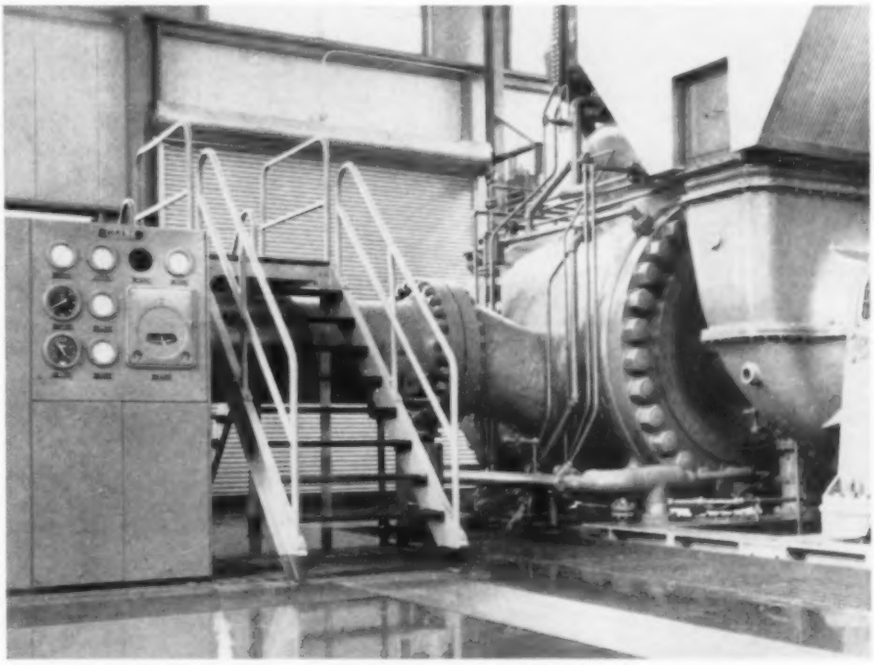
Only One Attendant is Assigned to the Station

Bechtelsville Compressor Station Cost

Station Cost	$ 3,337,201
Cost of Six station Cottages	120,000
Total Cost of Station	$ 3,457,201
Cost per Installed Horsepower	230.48

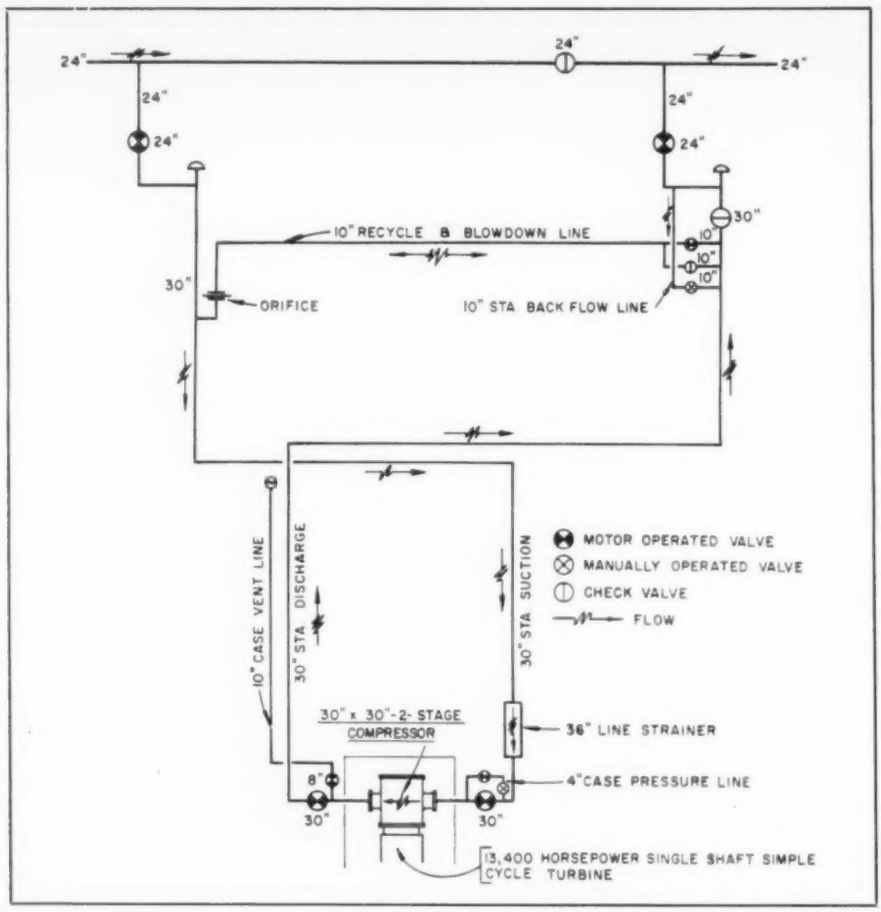
Station Operating Personnel at Bechtelsville:

1	Chief Operator
4	Operators (1 per eight hour shift)
1	Relief Operator
1	Mechanics Helper
1	Maintenance Man
1	Repairman
Total 9	

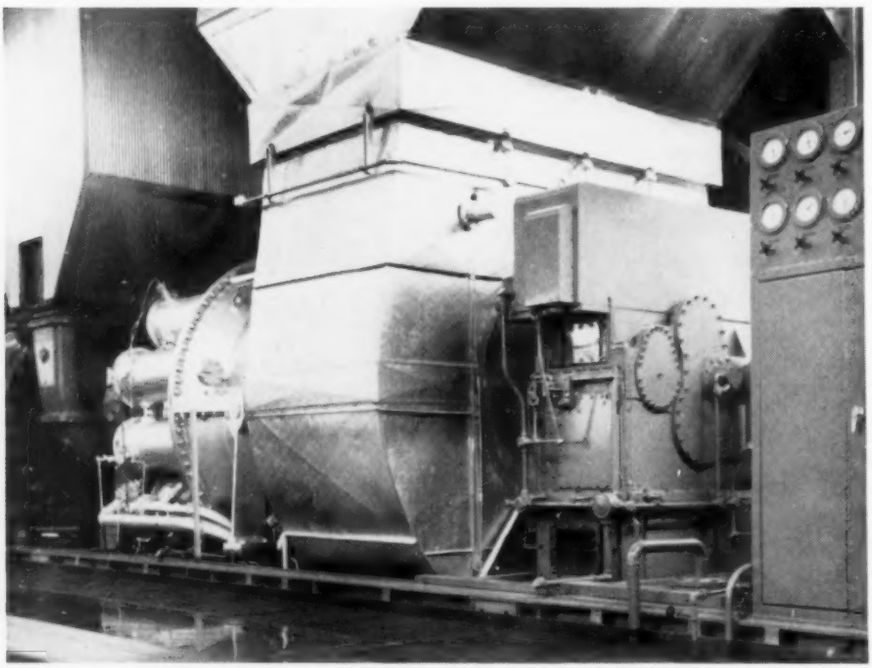


The single two-stage centrifugal compressor is of a barrel construction permitting removal and change-over of hydraulic internals when different flow conditions require it. Two 37-inch impellers are mounted back to back so thrust on start-up and in normal operations tends to balance out. Compressors are rated at 644 psi suction, 969 psi discharge, 4860 rpm and with horsepower rating for design conditions of 15,900 horsepower. This is approximately the 40° F ambient output of the gas turbine. A differential transducer sensing device on the discharge side of the compressor supplies an electrical signal to a highly stabilized low pass amplifier for surge control.

Two-Stage Compressor. Each of the satellite stations has a two-stage, uncooled, high-speed, high-pressure, single suction centrifugal compressor equipped with 37-inch impellers. Barrel construction of the compressor allows for removal and changing of hydraulic internals for different flow conditions. Two 30-inch ASA 600



Major gas piping layout for Texas Eastern's Bernville station. Special attention was devoted to control of surges in the large single unit centrifugal satellites. During start up surge conditions the recycle valve is kept from opening until the unit is on the line.



The giant gas turbines used at Texas Eastern's four satellite stations are rated 13,400-HP plus. Each is a simple cycle, single shaft combustion gas turbine rated at 4860 rpm, 1000 foot altitude and 80° F ambient temperature. Heat rate at these conditions is not greater than 12,250 Btu per brake horsepower hour. Thermal efficiency at this rating is about 20.8 percent. As ambient temperature is lowered, particularly during winter peak load operations, actual horsepower output is somewhat greater than rated. Theoretically turbines could deliver between 30 to 40 percent additional horsepower at ambients approaching 0° F.

flanges are located on a common center line.

The two impellers are mounted back to back so thrust on start up and in normal operations tends to balance out. High total weight of compressor unit assures holding proper alignment. Each compressor case was hydrostatically tested to 1,800 pounds per square inch for 24 hours; impellers were spin tested to 120 percent of maximum operating speed at the factory. Compressor operating characteristics are as follows:

Suction Pressure—644 psia
Discharge Pressure—969 psia
Compression Ratio—1.504
Rated Volume Inlet—10,830 cubic ft. per min.
Rated Head—17,660 ft. lbs. per lb.
RPM—4,860
Horsepower required for design conditions—15,900 HP (40° F. rating of turbine)

Foundations for the turbine and compressor are monolithic 2⅓-feet thick reinforced concrete mat. This mat also provides a foundation for the curtain wall of the turbine room section of the building. Top of the mat is 3 feet below finished grade elevation thus its base is below anticipated frost line.

Design for Remote Control. Control systems for each of the four intermediate satellite stations are identical in design. The satellite station and control panel at the manned station are linked with leased, common carrier communication facilities. These are four wire circuits; one pair used for transmission of controlling functions and the other pair for transmission of intelligence. The latter includes telemetered information from satellite to control station and alarm conditions. All control lines are in lead cable either overhead or in underground construction; this provides protection against weather, severe icing conditions and other natural hazards. Air distance, between satellite and control stations are 25 to 28 miles

Control Console. All instrumentation, alarm and indicating lights, control switches, and mimic bus for control of the satellite is housed in a single expandable console in the control room of the master station. Layout is arranged to present to the operator a clear picture of the actual condition at the satellite station.

In general, the design concept of the control system is patterned after that in Texas Eastern's remotely controlled reciprocating station at Linden, N. J. (See PIPE LINE INDUSTRY, November 1958, Pages 58-64.) However at the new turbine satellites, miniaturized escutcheons were used and there are no white disagreement lights to show when a particular condition differs from that set into the supervisory control. Instead of the disagreement lights, flashing of the red indicator light shows a condition different from that ordered. Control of the single unit turbine centrifugal station is somewhat simplier than start up, shut down and control of the reciprocating station at Linden.

Telemetered Functions. Fifteen functions are telemetered from the satellite to the control station:

1. Station Suction Pressure
2. Station Discharge Pressure
3. Station Suction Temperature
4. Station Discharge Temperature
5. Station Ambient Air Temperature
6. Turbine Exhaust Temperature Group (1)
7. Turbine Exhaust Temperature Group (2)
8. Wheel Space Temperature # (1) Fwd.
9. Wheel Space Temperature # (1) Aft.
10. Wheel Space Temperature # (2) Fwd.
11. Wheel Space Temperature # (2) Aft.
12. Turbine Load Factor
13. Unit Suction Pressure
14. Turbine Governor Set Point
15. Turbine Speed

The first 13 functions are translated by five-second, impulse-duration type telemetering. Functions 14 and 15 are translated via five pulses per second impulse duration type telemetering. The first five functions are time multiplexed on one teletype channel. Functions 6 through 11 share three teletype channels through use of time multiplex instrumentation.

Special attention was given to turbine speed in the control set-up. For purposes of accuracy and ease of comparison with the governor set point, the lower 78 percent of turbine speed is automatically suppressed; only turbine speeds above 3,880 rpm are transmitted to the control station. Minimum sustaining speed on the

Remote Operation Sequence

AUTOMATIC START-UP

Steps 1. To start the turbine all auxiliary, control and safe run switches must be on.

2. Valve positions must be as follows:

• Station Suction	— Open	• Unit Discharge	— Closed
• Station Discharge	— Open	• Unit Vent	— Open
• Station Vent	— Closed	• Unit Pressurizing	— Closed
• Unit Suction	— Closed	• Unit Recycle	— Closed

3. If these are correct the amber check and permissive start lights will now be lit.
4. The Start-Stop switch is shifted to the "Start" position and the following actions take place:
   - Auxiliary lube oil pump starts
   - Vapor extractor starts
   - Lube oil cooling water pump starts
   - Seal oil pump starts
5. If and when normal operating conditions are reached by step No. 4, the main turbine clutch, turning gear motor and turning gear clutch are engaged.
6. After one minute, the unit pressurizing valve begins to open; when this valve opens, its limit switch opens the starting turbine gas isolation and minimum speed valves and the turbine begins accelerating toward 30 percent speed. The turning gear clutch is then disengaged.
7. When the turbine reaches 30 percent speed, a three minute turbine purge begins.
8. At the end of the three minute purge spark plugs are energized; minimum fuel gas is admitted to the combustors by picking up the hydraulic control oil system and the firing timer delay relay is energized. If no combustion takes place within 15 seconds, a shutdown sequence is initiated as the firing time delay relay times out.
9. If ignition takes place and flame is detected, the first step fuel limit valve is energized to reduce the fuel to a minimum for combustion; a three minute warm-up period begins.
10. At the end of the first three minute warm-up period the first step starting turbine acceleration valve is energized; the turbine is accelerated to 35 percent, at which speed additional fuel is added by de-energizing the first step fuel limit valve. A second three minute warm-up period then begins.
11. After this second three minute period, the second step starting turbine acceleration valve is energized and the turbine is accelerated to 50 percent speed. At 50 percent speed, the second step fuel limit valve is energized and the turbine accelerates to 78 percent speed.
12. As the turbine reaches 78 percent speed, the third step fuel limit valve is energized; the turbine is now self-sustaining. The starting turbine gas isolation valve closes and the main turbine clutch is disengaged. Unit suction and discharge valves begin to open; when both are 2 percent open, the unit vent valve begins to close. When the unit suction valve reaches a pre-set (about 25 percent open) position, it stops its travel and the unit pressurizing valve begins to close. After the unit discharge valve is 100 percent open, further opening of the unit suction valve is dictated by the load controller.
13. The satellite station is "On The Line."
14. Turbine speed is now under the control of the speed governor.

NORMAL SHUTDOWN SEQUENCE

Steps 1. To shut the station down, the start-stop switch is set to the "stop" position; this dumps the hydraulic control oil system cutting off the fuel to the turbine. Unit suction and discharge valves begin to close and the unit vent valve begins to open. The seal oil pump stops when the unit valve is wide open.

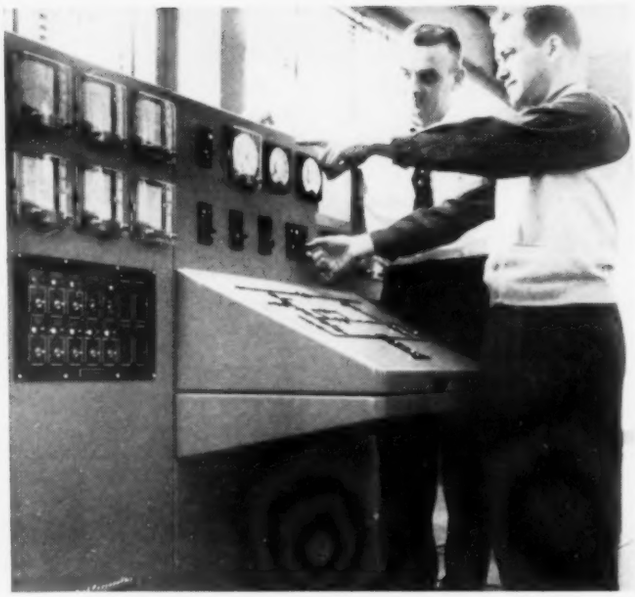
2. The auxiliary lube oil pump starts when the pressure drops to 46 psi or the speed drops below 78 percent.
3. As the turbine coasts down, a timing relay is energized; after the turbine is at standstill (zero RPM) the timer brings in the turning gear motor, its clutch and the main turbine clutch; the turbine is now in a 48 hour cool-down cycle. Turbines may be restarted at any time during the cool-down period.
4. Any shutdown protective device causes the above shutdown sequence to occur automatically.

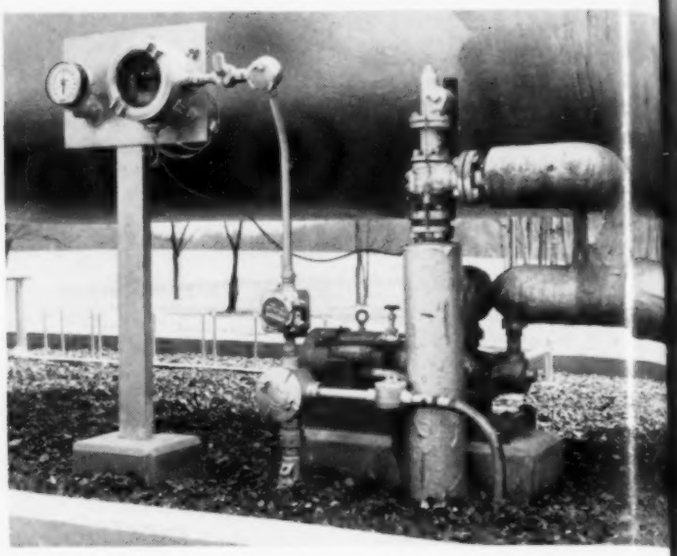
EMERGENCY SHUTDOWN

1. An emergency shutdown causes all the normal steps in the shutdown sequence plus the closing of station suction and discharge valves and opens the station blowdown valve and exhausts station piping to the atmosphere.

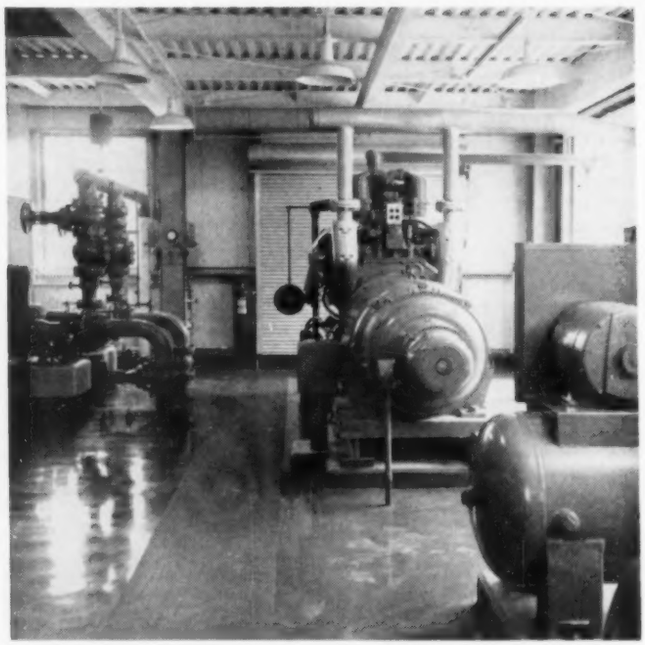
The emergency shutdown system can be actuated by operating a push button switch in the turbine building, an emergency shutdown switch on the control panel in the control room, an emergency switch in the station cottage, an emergency switch on the control panel at the remote control station, or any of three manually operated stations in the yard area.

Any of these actions causes the system to close the station suction and discharge valves and open the blow off valve. It also breaks the contacts on a mercury switch de-energizing a relay which initiates normal turbine shutdown. In the event of emergency shutdown, however, the turning gear motor circuit is inactivated. This emergency shutdown system is a fail-safe lock out; it can not be reset from the remote control station.





(upper left) Control console at Bechtelsville located about 25 miles downstream from the Bernville satellite. C. W. Marvin, Texas Eastern assistant chief engineer, goes through the start up sequence as R. J. Mathias, assistant chief of communications, observes. Basic control concept was similar to that used at Texas Eastern's unattended reciprocating station at Linden, New Jersey. In the new satellites, escutcheons were miniaturized and a flashing red signal takes the place of disagreement lamps used in the earlier design. All instrumentation, alarm and indicating lights, control switches and mimic bus for control of the Bernville satellite is housed in the single, compact, expandable console.



(above) Synthetic lubricant, a phosphate ester-base compound, is used in both the turbine and compressor lube oil systems. A 3000 gallon storage tank located adjacent to the compressor building provides make up; because of the viscosity characteristics of the synthetic lube it is necessary to maintain a temperature of 70° F. The storage tank is insulated; an electric immersion heater is installed in the piping; and a 10 GPM positive displacement pump recirculates lubricant between the storage tank and the compressor building. A lubricant reservoir is built into the turbine base and maintained at 70° F by six electric immersion heaters.

(left) In the event of purchased power failure, an emergency 300 KW gas engine driven generator automatically starts and picks up the power load of the station. When power is again available, the resident attendant may return the station to normal power service by synchronizing with the utility and tripping out the auxiliary generator breaker. Cooling water pumps and a nickel-cadium battery bank are located just to the left of the auxiliary power unit.

turbine is approximately 3,800 rpm.

Surge Monitoring and Control. Particular attention was given in the large centrifugal satellite stations to control of possible pressure surges. To do this the station recycle valve is automatically opened if a surge condition occurs; when surge ceases the valve is closed by a surge controller.

This controller consists of a differential transducer connected to the discharge side of the compressor. It furnishes an electrical signal to a highly stabilized low pass amplifier. The amplifier determines whether or not a surge problem exists and through the auxiliary relay circuit opens the recycle valve. During start up the recycle valve is kept from opening until the unit is on the line; this is done by locking out the auxiliary relay circuit by sensing the position of the unit suction valve.

Communications Channels. The control circuit has a band pass of 1,300 cps between the 3 db points of 1,000 and 2,300 cps. Within this band pass there are three telegraph type channels with a maximum dot cycle rate of 35 at frequencies of 1,105, 1,615, and 1,785 cps. A channel on 1,785 cps is used to monitor the control line.

Telegraph type channels at 1,105 and 1,275 cycles are frequency shift modulated, plus or minus 35 cps. This develops the four tones 1,310, 1,240, 1,140, and 1,080, which are used to send control information to the satellite. This provides tone sequence control; an order is recognized by the sequence in which the tones occur. The code thus being generated is protected for fidelity by the length of each tone, the spacing between each tone, rejection of dual appearance of tones, and the finite frequency of each tone.

The telemetering and alarm circuit has a band pass of 2,600 cps at the 4 db points of 400 and 3,000 cps. Within this band pass eleven telegraph type channels with a maximum dot cycle rate of 35 are developed.

All channels are frequency shift modulated plus or minus 35 cps.

Three of these channels on 1,105, 1,275 and 1,785 are used for telemetered line monitor, in sequence alarm or indication reply, and immediate alarm or indication reply. The remaining eight channels are used to telemeter information from the satellite to the control station.

Station and Turbine Control. Two principal rules tested every design feature in Texas Eastern's new 15,000 horsepower centrifugal stations.

- First the system had to be fail-safe in every detail.
- In addition, the station must continue to run on a purchase power outage until such time as the auxiliary generator picks up the load. In the event of auxiliary generator failure and absence of purchased power then the turbine will shut down safely with the battery bank supplying necessary power for safe shut down and securing of station.

Station and turbine duplex control panels consist of two matching sections. The station section contains all of the control relaying protective devices and instrumentation associated solely with the station. In the other section are all of the equipment for the turbine. This provides a definite division of equipment and functional intelligence in control. Supervisory equipment is located adjacent to these control panels.

Automatic Sequencing. To meet the demands of completely fail-safe operation and the requirements of "carry over" in the event of power failure, two turbine control busses were used. These were a 125 volt DC, solidly grounded; plus a 120 volt AC, solidly grounded.

Completely automatic forced sequence is employed using the DC as a prime control system bus. Sequence is designed to be completely fail-safe; loss of intelligence or a component failure will immediately cause a shut down.

Both the station and turbine are completely self-protected within themselves. Safety of the station is in no way dependent upon continuity of supervisory control equipment or the supervisory channel links. The station master selector is arranged so that control of the station may be transferred to the controlling station or to the local position at the duplex board at any time even while the station is running. Basically, the remote control equipment provides long extension handles to the local control incorporated in other stations on Texas Eastern's Penn-Jersey line.

Synthetic Lubricant System. Considering the large investment in high horsepower, single unit turbine compressor units Texas Eastern engineers decided on the use of a fire resistant synthetic lubricant. The material selected is a phosphate ester base lubricant; one of several produced by major chemical companies. These lubricants have had wide application for aircraft turbines and other special services. However it was the first application of synthetic lubricant to a gas turbine compressor unit.

Synthetic lubricant is used in both the turbine and compressor. It lubricates the compressor bearings and also serves as the sealing media. Seals are precision, close tolerance, floating ring-types using lubricant under automatically controlled pressure to provide positive sealing against gas leakage around the rotor shaft.

Lubricant is supplied to the turbine parts by a 225 gallon per minute positive displacement pump driven off the main turbine shaft. During start-ups, shutdowns or failure of the main pump, an auxiliary 15 horsepower, 440 volt AC motor driven centrifugal pump is employed.

In emergencies when neither main pump or auxiliary is available, a 125 volt DC motor drives a three horsepower centrifugal pump to supply lubricant to the main header during shutdown. In addition to turbine and compressor lubrication, the flexible coupling, starting turbine and control system devices are served from the common lubricating system.

Heated, Insulated Lube Tank. The lubricating and sealing system is a closed system. All lubricant pumped from the turbine base reservoir flows through the tube and shell heat exchanger, a magnetic filter, a primary filter, and a secondary filter before it reaches bearings and seals. All lubricant then drains back to the turbine base reservoir.

This reservoir is kept at a minimum temperature of 70° F. by six electric immersion heaters in the reservoir and by turbine room space heaters. Make-up lubricant added from a 3,000-gallon storage tank located outside the station is forced to the turbine sump by controlled air pressure. It first passes through a filter and a meter.

The 3,000-gallon make-up lube tank located adjacent to the station has a complete insulation jacket; an electric immersion heater is installed in the piping. A 10 gallon-per-minute, positive displacement pump recirculates lubricant. The recirculating line is also fully insulated.

Modifications for Synthetic Lube. To insure compatibility of the synthetic lubricant with turbine and compressor parts, Texas Eastern engineers worked with design engineers of manufacturers of both turbines and compressors. Where necessary, gaskets, packings, "O" rings, thread compounds and other materials were selected to be compatible with the phosphate ester-base lubricant.

Lube pump impellers were reduced in diameter to facilitate pumping the heavier fluid.

Oil-Water-Air Heat Exchanger. Originally the lube oil cooling units were set up to be cooled directly. However, considering the viscosity of the synthetic lubricant at low ambients, systems were revamped to make use of a closed cycle oil-water-air cooling system. Lubricant is cooled with water within the heated building; hot water passes to the air cooled finned-tube exchangers outside the station. To prevent water from freezing in the system during coldest weather; particularly if the turbine should be shut down at those times, a solution of ethylene glycol is added to provide a 40 percent solution by weight.

Lubricant Record Good. After 3,000 operational hours with the fire resistant lubricants, Texas Eastern engineers reported no difficulties have occurred which could be traced to the characteristics of this product. Fire resistance of the fluids has been proven in several tests. Fluid consumption and general stability of the lubricant so far have been very satisfactory.

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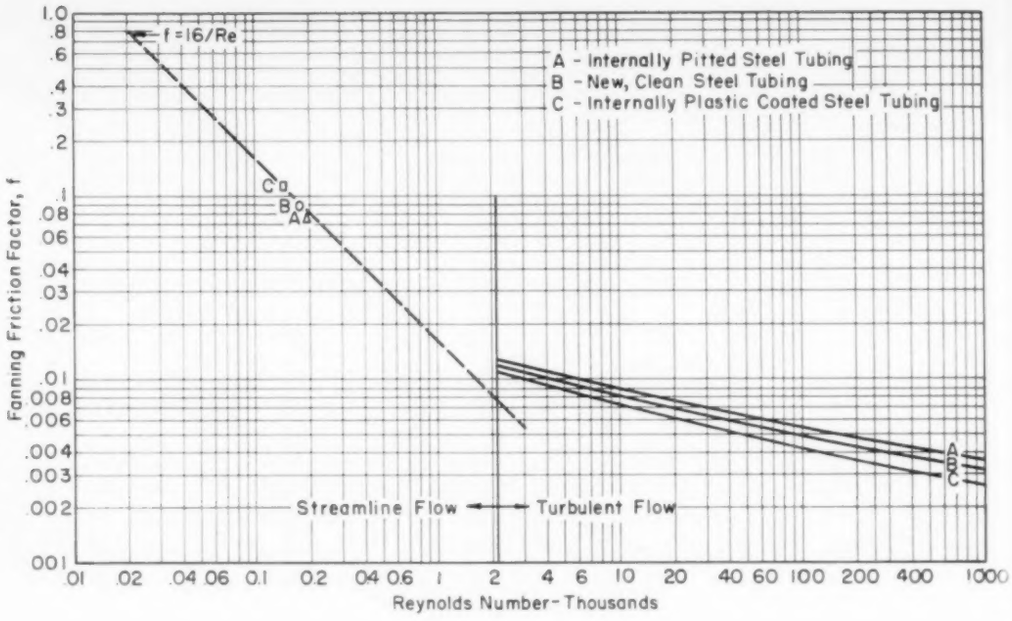
f = 16/Re
A - Internally Pitted Steel Tubing
B - New, Clean Steel Tubing
C - Internally Plastic Coated Steel Tubing
Fanning Friction Factor, f
Streamline Flow
Turbulent Flow
Reynolds Number - Thousands

FIGURE 1—Experimental Fanning friction factors. Note the advantages internal coatings offer in the high Reynolds number region of turbulent flow.

Report on Internal Coatings

What Slick Coatings Will Do for Flow In Small Diameter Lines

A laboratory investigation shows that friction losses for internally coated pipe may be 17 to 25 percent less than for new uncoated pipe

By Herman Levin and Morey Gephard
Southwest Research Institute, San Antonio

INTERNAL COATINGS of thin film plastic were initially installed in line pipe and oil well tubing to reduce corrosion. A laboratory investigation shows that the side benefits almost overshadow the original purpose of installation. The reduction in friction is appreciable.

The laboratory project described here was designed to experimentally evaluate such friction loss reductions over a wide range of flow conditions for various type internal pipe surfaces.

Experimental Equipment and Procedure. Fluid flow tests were conducted in 30-foot sections of two-inch upset tubing. In order to determine the effectiveness of an internal coating, flow data were obtained for internally coated new tubing, uncoated new tubing and internally pitted tubing. The coated tubing used for this work had an internal "thin film" plastic coating on a pickled, grit blasted surface. The coating was a five-coat application of straight baked phenolic prime coats followed by three coats of thermo-setting phenolic modified epoxy. It averaged 5.5 mils in thickness.

The test assembly consisted of a circulating pump discharging into a 30-foot section of two-inch coated tubing which served as a flow straightener. Attached to this was a test section which then discharged into a 3-inch aluminum line which returned fluid to a 55 gallon reservoir. This reservoir was used to maintain a fixed head on the pump suction.

Measurements. Head losses across the test sections were measured by upstream and downstream pressure taps. Fluid temperatures were measured by thermometers immersed in the flowing fluid. Flow rates were obtained by an orifice flow meter. Data were recorded when steady state conditions were reached at each set of flow conditions. In the streamline region, a 2,000 SSU (82.5° F.) oil was the test fluid. Its viscosity-temperature characteristic was carefully determined beforehand. Water was used as the test fluid in the turbulent flow region.

Average inside tubing diameters were determined by volumetric displacement with water at a measured temperature.

Correlation of Flow Data. The experimental data are tabulated in

Tables 1 and 2. From these data, corresponding friction factors were calculated using the well known Fanning equation for steady isothermal flow in straight circular pipes:

$$F = \frac{2fLV^2}{gD} \quad \text{Rearranging:} \quad f = \frac{FgD}{2LV^2}$$

where F = measured friction loss, feet of fluid flowing
f = Fanning friction factor
L = tubing length, feet
V = average velocity, ft/second
g = 32.17 ft/sec²
D = inside tube diameter, feet

The calculated F values were then graphically correlated in the conventional manner with corresponding Reynolds number values as shown in Figure 1.

Williams and Hazen coefficients were determined for the various types of internal tubing surfaces. The following equation was used:

$$F = 0.2083\left(\frac{100}{C}\right)^{1.85}\left(\frac{q^{1.85}}{D^{4.8655}}\right)$$

where:
F = friction loss, feet of fluid flowing per 100 ft of pipe
C = Williams and Hazen coefficient
q = flow rate, gpm
D = inside diameter, inch

It should be recognized that the above equation is based on a liquid viscosity of 1.1 centistoke (e.g., water at 61°F.). Calculation of "C factors" for fluids of differing viscosity will result in marked discrepancies. This fact will be noted in the "C factors" shown in Table 1 where viscosity differences resulting from temperature variations in the water occur.

Performance of Coated Tubing. Correlation of the results indicate that: (1) **at the low end of the turbulent region, friction losses in new tubing are of the order of 10 percent above those in coated tubing, (2) in the middle of the turbulent region friction losses are of the order of 17 percent more, and (3) at upper part of the turbulent region friction losses are of the order of 20 percent higher.**

At corresponding flow conditions, even higher friction losses were measured across internally pitted pipe. The findings demonstrate that the effectiveness of an internal coating increases with increasing Reynolds number and is a function of both coating smoothness and thickness. In the absence of turbulence, streamline flow region, flow resistance is independent of the nature of the internal tube surface.

Maximum reduction in flow resistance is achieved by a plastic coating of maximum smoothness and minimum thickness. As would be predicted, the effect of coating thickness in reducing the internal diameter is more significant in small diameter tubing than in large. For example, at a Reynolds number of 10^5, the 5.5 mil coating in the 2-inch test section demonstrated a friction factor reduction of 14.4 percent. This normally represents the reduction in pressure drop also. In the case of 2-inch tubing, 18 percent of this saving is lost as a result of the 11 mil reduction in internal diameter; in the case of 4-inch tubing, 9 percent is lost; and in the case of 6-inch tubing, 6 percent is lost.

The above are based on a comparison of internally coated new tubing versus new tubing. Comparison of coated tubing versus corroded or scaled tubing in service would probably reduce the effect of diameter reduction to insignificance.

Williams and Hazen coefficients, often referred to as "C factors", are conventionally used as a measure of internal surface roughness. These factors were experimentally determined and average values were found to be as follows:

TABLE 1—Experimental Fanning Friction Factors for Turbulent Flow Range

TEST TUBING	Water Flow Temp., °F	Flow Rate GPM	Velocity Ft./sec	Reynolds No. Re	Measured Friction Loss, Ft. Water Ft.	Fanning Friction Factor, f	C, Williams and Hazen Coefficients
New Clean, Steel Tubing*	67.5	27.78	2.926	45,433	0.01827	0.0058834	142
	67.5	71.69	7.044	109,380	0.08539	0.004705	149
	67.5	105.59	10.375	161,080	0.1724	0.004379	149
	67.5	130.17	12.79	198,590	0.2577	0.004315	149
	67.5	166.72	16.38	254,350	0.3935	0.004009	151
Internally Plastic Coated Steel Tubing†	75	47.61	4.954	82,652	0.03832	0.004147	171
	75	62.47	6.499	108,444	0.06957	0.004376	157
	75	91.45	9.514	158,750	0.1138	0.003340	176
	75	106.3	11.06	184,525	0.1634	0.003555	169
	78.4	62.5	6.499	112,691	0.06472	0.004070	164
	78.4	142.0	14.77	256,107	0.2735	0.003331	171
	78.4	30.8	3.204	55,556	0.01839	0.004759	159
Internally Pitted Steel‡	64.5	43.3	4.505	65,570	0.0353	0.004620	157
	64.5	165.0	17.17	249,909	0.3763	0.003391	167
	72.0	4.59	0.4773	7,666	0.000675	0.00787	
	75.5	32.26	3.366	56,441	0.02718	0.006365	134
	75.5	70.75	7.381	123,784	0.1073	0.005225	140
	75.5	111.75	11.658	195,505	0.2446	0.004777	142

* New, as received, steel tubing. Length = 30.120 ft. Average I.D. = 2.0393 in. (as measured volumetrically, using water).
† Internally coated Length = 30.198 ft. Average I.D. = 1.9815 in. Average coating thickness = 0.0055 in.
‡ Internally pitted tubing. Length = 30.458 ft. Average I.D. = 1.978 ft.

TABLE 2—Experimental Fanning Friction Factors for Streamline Flow Range

TEST TUBING	Oil Flow Temp. °F	Density at t, g/cc	Viscosity, Centipoise	Flow Rate, gpm	Velocity, Ft./Sec	Reynolds Number, Re	Friction Loss, Ft. Oil/Ft	Fanning Friction Factor, f
New, Clean*	101	0.865	196.4	27.18	2.67	190.6	0.2308	0.0887
Plastic Coated†	102	0.8655	202.5	21.43	2.23	141.5	0.2065	0.110
Pitted‡	101.5	0.8653	199.5	29.41	3.07	197.3	0.2623	0.074

* New, as received, steel tubing. Length = 30.120 ft. Average I.D. = 2.0393 in. (as measured volumetrically, using water).
† Internally coated. Length = 30.198 ft. Average I.D. = 1.9815 in. Average coating thickness = 0.0055 in.
‡ Internally pitted tubing. Length = 30.458 ft. Average I.D. = 1.978 ft.

New, Coated Tubing: 165
New Tubing (as received): 148
Internally Pitted Tubing: 138

These values indicate an average 11.5 percent increase in smoothness as a result of coating new tubing. The internal surface of the coated tubing was 19.5 percent smoother than that of the pitted tubing. This latter is only representative since the extent and nature of corrosion, especially as it relates to internal surface roughness, can vary widely.

In terms of pipe line operations the pressure drop reductions afforded by internal resin coating may be translated into reduced pumping costs or increased throughput for the same pumping costs. The magnitude of such savings will depend on the type and length service and the flow conditions in the line.

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About the Authors

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Herman Levin is manager of chemical engineering research at Southwest Research Institute. His activities in the field of oil and gas technology include special flow problems, equipment development, and new formation stimulation techniques. He holds an M.S. degree in chemical engineering from The University of Texas (1948) and has been associated with the Ethyl Corporation and Wyatt C. Hedrick Engineering Corporation.

Morey H. Gephard, associate chemical engineer in the Chemical Engineering department of Southwest Research Institute graduated from The University of Texas in 1948. His first job was with Phillips Petroleum Company in the Natural Gasoline department. In 1951 he joined SRI where he has been engaged in many research problems connected with the oil and gas industry.

New Remotely Controlled Turbine Units

Continued from Page 31

Electrical System Design. Purchased power is used for starting and normal operational power demands. The utility companies supply this power at 480 volts, three-phase. All auxiliary equipment such as pumps, cooling fans, electrical space heaters, and yard area mercury vapor lights are operated at this voltage. Interior lighting and other small power requirements are supplied at 120 volts AC through a three-phase "wye" connected bank of transformers mounted in the switchgear.

In the event of purchased power failure or unavailability, emergency power is supplied by a 300 KW generator driven by V-12 internal combustion engine burning natural gas. It is automatically started and picks up the power requirements of the station when necessary. When purchased power again is available, the resident attendant may at his own discretion return station operations to the utility by synchronizing power and tripping out the auxiliary generator breaker.

A 125-volt nickel cadmium battery bank is used for the DC control bus, supervisory equipment, emergency instrument power, emergency lighting, and all key emergency station shutdown facilities.

Compressor Building Design. The compressor building, a structural steel rigid frame flat roofed structure, is divided into two sections by an 8-inch brick fire wall. The larger section houses the turbine, the compressor and attendant equipment. Control equipment, auxiliaries and storage space is provided in the smaller section.

Building exterior is of "sandwich" type panel consisting of 1½-inch glass fiber insulation between flat galvanized steel on the interior and anodized diamond patterned aluminum on the exterior. This siding was used for appearance and because of its rapid and economical erection; it also promises low maintenance cost and good heat insulating properties.

No basement is provided under the compressor building. There is a narrow trench around the turbine and compressor to facilitate piping and electrical connections to the prime mover and compressor. This trench was somewhat more economical than a full basement.

Placement of equipment in the turbine room provides as much clear working space as possible for maintenance. Fuel gas regulating and measuring equipment is located along one wall; the turbine and compressor are offset from the building centerline toward the fuel gas equipment. Offsetting the turbine and compressor in this way added to clear working space and also reduced the length of turbine air intake and exhaust ducts.

Sufficient heaters are provided in the turbine room to maintain an inside temperature of 70° F. when the outside temperature is 0° F. and the turbine is shut down. This was necessary because of the viscosity characteristics of the synthetic, phosphate ester, fire resistant lubricant used in the turbine and compressor.

Gas Piping. At the new intermediate turbine stations approximately 800 feet of 24-inch main line piping was replaced with heavy wall (24-inch, 0.594 inch wall) pipe having a 46,000 psi minimum specified yield. Suction and discharge taps were made of the heavy wall pipe at a spacing of 200 feet. Room is thus provided for addition of future scraper traps.

A full opening check valve permits passage of scrapers and also by-passing of the station. Station suction and discharge lines are of 30-inch .783 wall pipe. The 10-inch recycle line permits recirculation of gas from station discharge to station suction: It is equipped with a 10-inch electric operated gate valve controlled automatically to eliminate gas compressor surge conditions. A 36-inch OD by 7-foot 6-inch long pipe line strainer is installed in the station suction line.

Construction contractor on the Bernville satellite station was Midvalley Utilities Constructors, Inc. Brown and Root, Inc., was the engineering contractor.

ACKNOWLEDGMENT

PIPE LINE INDUSTRY acknowledges the assistance of many Texas Eastern engineering and operating management who assisted in the preparation of this article. Special thanks go to A. J. Shoup, vice-president and chief engineer; C. W. Marvin, assistant chief engineer; George Ewing, assistant supervising engineer; E. T. Robinson, Jr., general superintendent; W. E. Worley; superintendent of compressor station; R. J. Mathias, assistant chief of communications; T. R. Monk, Jr., and Harry Marmion.

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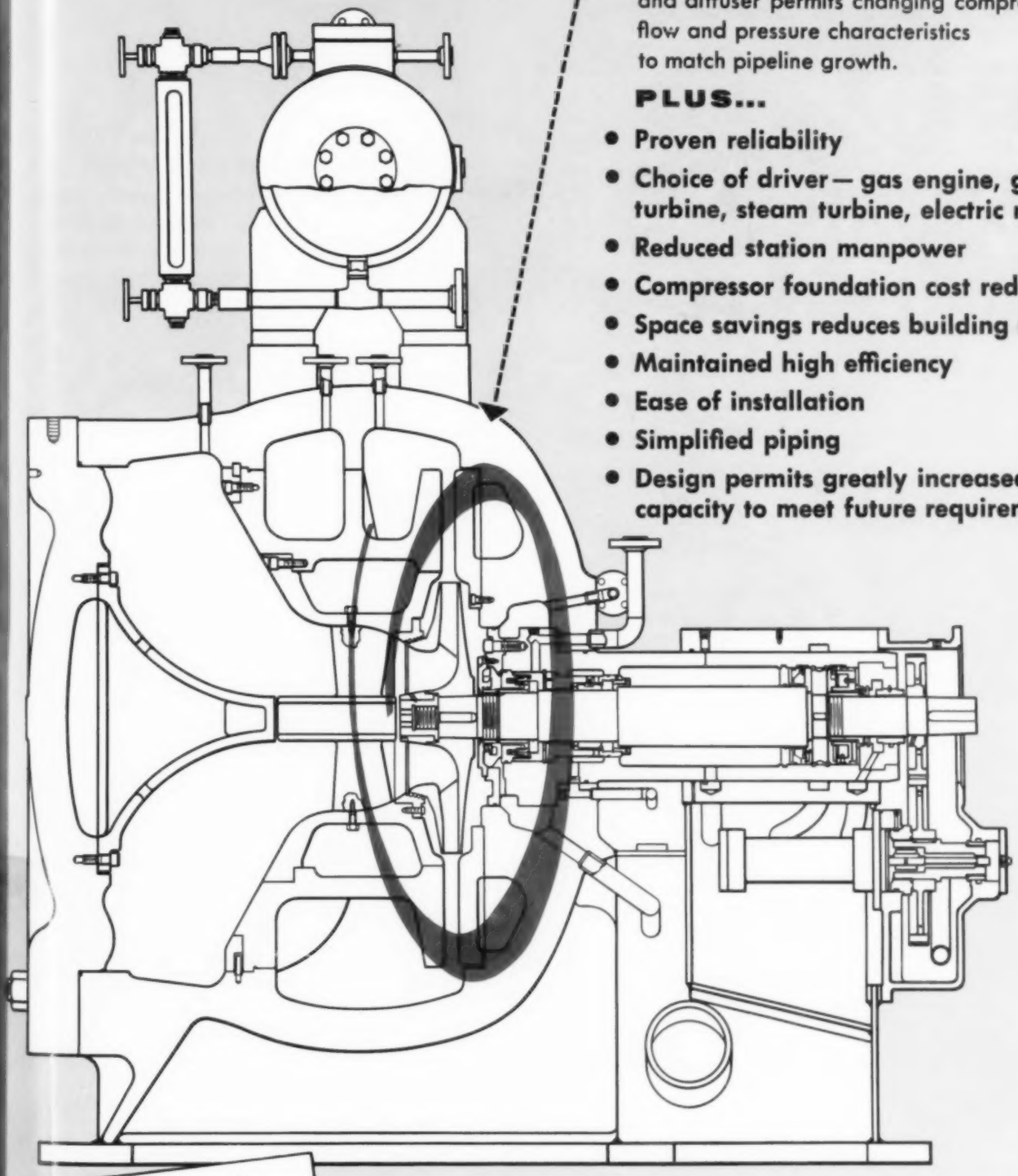

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Each of these methods of increasing horsepower has its advantages . . .

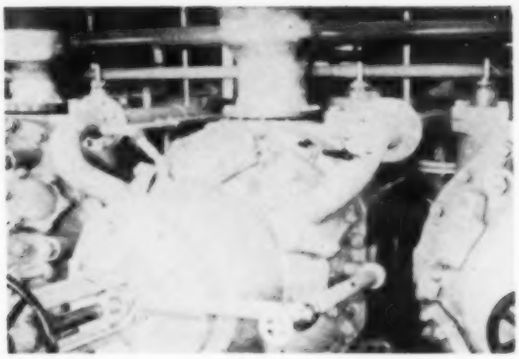


FIGURE 1—One way of supercharging an existing engine is to convert a compressor cylinder to scavenging air service. Here a 25-inch gas compressor cylinder has been installed to operate in parallel with conventional scavenging air cylinder.

Five Ways to Supercharge Existing Two-Cycle Engines

By Robert G. Bolfing and Jerry F. Todd
Magnolia Petroleum Company
Dallas

MAGNOLIA PETROLEUM COMPANY first supercharged two-cycle gas engines ten years ago. As of now, the company is operating two-cycle engines supercharged by *five* different methods.

Each of these different types of supercharging was adapted to existing engines. When the need for more horsepower arises, a long look is taken at this method of securing it. A detailed study will serve to determine the most economical method; often the method requiring the least initial investment is not necessarily the most economical means. Operating costs must be considered. Scavenging air, parasitic load on the engine and the amount of increase in horsepower must also be considered.

Five methods of supercharging used by Magnolia are as follows:

1. Conversion of one large gas compressor cylinder to scavenging air compression service is parallel with existing scavenging air pumps.
2. Installation of a positive displacement scavenging air blower in parallel with existing scavenging air pumps. The blower is V-belt driven from a sheave on the flywheel end of engine.
3. Installation of an electric motor driven positive displacement blower in parallel with existing scavenging air pumps.
4. Installation of an exhaust driven blower in parallel with existing scavenging air pumps (termed parallel turbocharging).
5. Installation of an exhaust driven blower in series with an existing gear driven centrifugal scavenging air compressor (termed series turbocharging).

Here is a discussion covering each of these five methods of furnishing supplemental scavenging air (supercharging) for existing 2-cycle gas engines.

Conversion of an Existing Gas Compressor Cylinder to Scavenging Air Service. Figure 1 shows a 25-inch gas compressor cylinder converted to scavenging air compression service, operating in parallel with the conventional scavenging air pumps. The supercharged unit was a 14 x 14 V-angle gas compressor.

The gain in rated brake horsepower was about 23 percent, while the installation cost per horsepower gained was only about 24 percent of the installed unit horsepower cost of a new engine.

This method of supercharging should be considered only where there is a large compressor cylinder which is not needed for gas compression service or where there is an extra crankshaft throw on which a cylinder for scavenging air service may be installed. It is worth noting that this arrangement puts a relatively large parasitic scavenging air compression load on an engine.

V-Belt Driven Positive Displacement Blower. Installation of a positive displacement blower in parallel with existing scavenging air pumps on a 14 x 14 V-angle compressor unit was accompanied by a 23 percent increase in horsepower rating. This blower is V-belt driven from a sheave mounted on the flywheel end of the engine.

Cost per horsepower for this blower installation is also about 24 percent of the per horsepower cost of a new engine installation.

Maintenance cost of this type blower is very low. This method of supercharging is advantageous when the main consideration is low initial

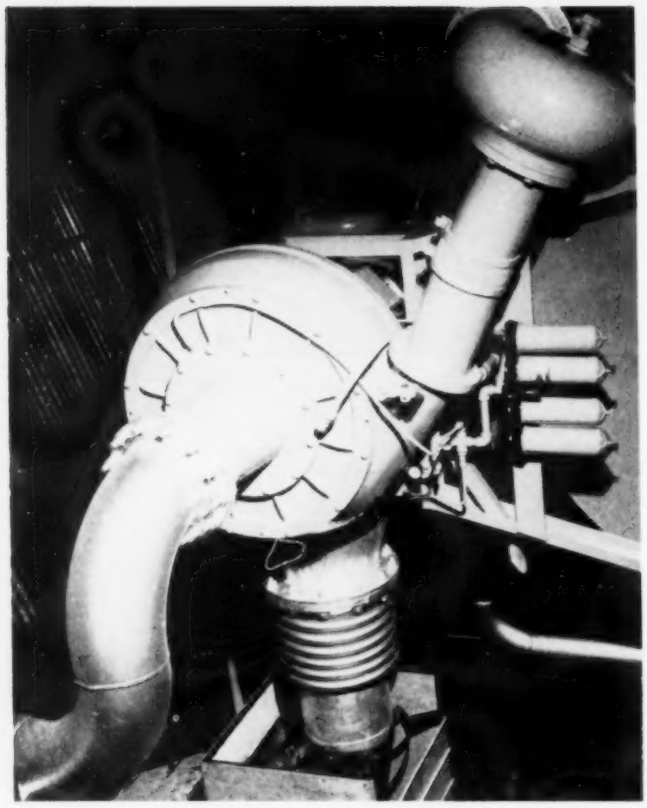


FIGURE 2—Exhaust-driven turbocharger hooked in parallel with scavenging air system.

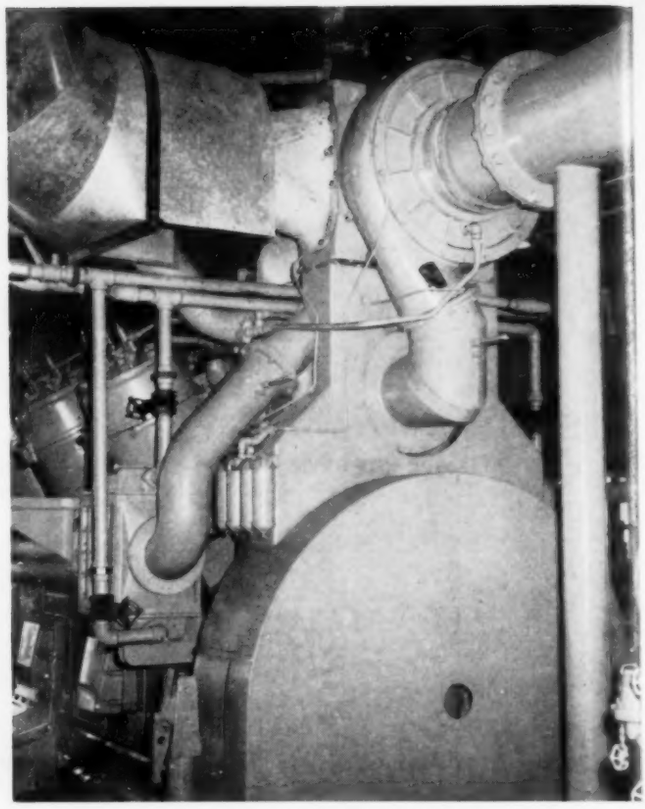


FIGURE 3—Exhaust-driven turbocharger driven in series with scavenging equipment.

investment cost. But it, too, induces a parasitic load on the engine.

Electric Motor Driven Positive Displacement Blower. Magnolia designed and installed an electric-motor-driven positive displacement blower system in parallel with existing scavenging air pumps on three 14 x 14 V-angle gas compressor units. Maximum load carrying ability was increased 50 percent by furnishing a total scavenging air supply of about twice the engine piston displacement.

Cost per horsepower for installation of this type supplemental scavenging air system is about 20 percent that of the per horsepower cost of a new engine installation.

Advantages of this system of supercharging are low initial investment, and low parasitic scavenging air load on the engine. Gas compression loads at this installation required horsepower equivalent to maximum frame rating of the engine. Therefore, by shifting part of the scavenging air load from the compressor engine to the electric power system, we have more net horsepower available for compressing gas.

Operating expense for this type supercharging is high. Therefore, it would not be the most economical way in which to supercharge unless you are considering a short term project.

This method of supplying supplemental scavenging air was justified because of engineer predictions that the supercharging equipment would be needed for a period of only two or three years, and, of course, low initial cost outweighed operating cost. Maintenance cost of electric motor driven blowers is low.

Parallel Turbocharging. This method of supercharging consists of an engine exhaust turbine driven scavenging air blower connected in parallel with existing scavenging air pumps. Parallel turbocharging increased the rated horsepower of our conventionally scavenged 14 x 14 V-angle compressor units by 23 percent.

Installation cost per horsepower for the turbocharger is about 40 percent of new engine installation cost per horsepower. We tested one of our parallel turbocharged engines up to a load of 145 percent of manufacturers' supercharged rating, or about 179 percent of its original rating.

During the test period, combustion characteristics were good and orsat analysis run on the engine exhaust gas indicated that 155 percent to 180 percent excess air was present. Some of the advantages of this type supercharging are as follows:

1. Relatively low scavenging air parasitic load on the engine.
2. Relatively constant fuel-air ratios with load changes.
3. Relatively high engine efficiency, which means low specific fuel consumption.

Figure 2 is a view of the turbocharger which is mounted above the engine flywheel.

Until now we have not employed scavenging air cooling with this method of supercharging, even though it is available from the manufacturer as a package with the turbocharger. It has been our experience that scavenging air cooling is generally not necessary when the following conditions are met:

1. Scavenging air volume of about twice engine piston displacement where engine is rerated to not more than 150 percent original standard rating.
2. Fuel gas higher heating value does not exceed approximately 1,500 Btu per cubic foot.
3. Where the engine is relieved of a portion of the scavenging air parasitic load. (This is the case with

turbocharging and electric motor driven scavenging air blowers.)

4. Maintaining good scavenging efficiency of the engine (intake and exhaust ports plugged with carbon decreases scavenging efficiency).
5. Proper engine ignition timing.

Series Turbocharging. One of the first field engines to be series turbocharged is located at Magnolia's Pegasus gasoline plant, near Midland, Texas. The 14 x 14 V-angle compressor unit was originally equipped with a gear driven centrifugal blower which supplied all of the scavenging air. The turbocharging kit consisted of an engine exhaust turbine driven centrifugal air blower in series with the existing gear driven blower, a scavenging air precooler, and an aftercooler. The original rating of the engine was 1,350 bhp.

The series turbocharging kit installation increased the rating to 1,800 bhp. This particular engine frame design which we will call a standard frame was found to be the limiting factor in maximum horsepower rating.

During periods of high compressor station inlet gas volumes, it was observed that the series turbocharged engine was carrying as high as 2,200 bhp gas compression loads. At these high loads, there was no deterioration in combustion characteristics. However, mechanical maintenance difficulties became a problem. Higher attendent scavenging air pressures caused gasket failures between power cylinders and the bedplate. Breakage of the top power piston rings posed a threat to the turbocharger, because pieces of the broken rings passed through the cylinder exhaust ports and through the exhaust manifold to the turbine where damage was done. It appeared that power cylinder life was a borderline case at the higher firing pressures attending high bhp load. The most serious weakness was in the main engine frame, which broke in several places. Attempts at repairing the breaks proved to be unsuccessful.

At this stage of supercharging, it became apparent that it was no longer a problem of how to get more combustion air and fuel gas into the cylinder, conditioned in such a way as to result in smooth, detonation free combustion. Instead, the problem became one of mechanical stress overloading of the engine parts. After a test period of approximately one year, operating at gas loads of 1,800 bhp and higher, the series turbocharged unit was modified in the following manner:

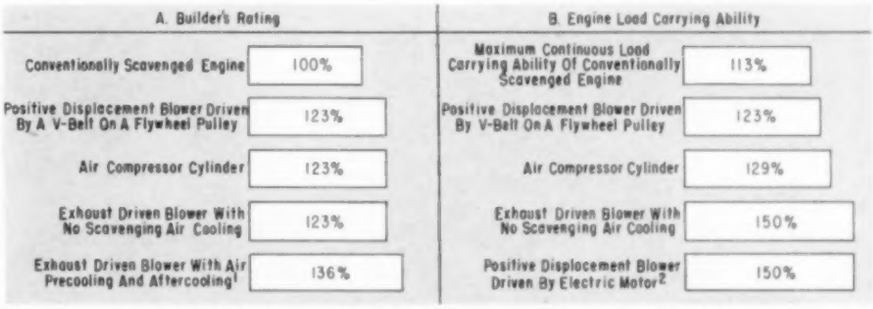
1. The engine main frame was replaced with one of stronger design.
2. Trimetal connecting rod bearings and aluminum main bearings were installed, replacing standard babbitted bearings.
3. Standard power cylinders were replaced with chrome plated cylinders.
4. The top two piston rings were replaced with rings of a different design.

During this modification work, a new turbocharger was installed. The original one had been damaged by the pieces of broken piston rings which passed through it. Since modification, this series turbocharged engine has been operated under an 1,800 bhp gas load for about 2½ years, during which time several major inspections have been made. Several chrome cylinder failures and rapid piston ring wear have been experienced. However, piston rings of a new design have been installed and are performing satisfactorily at present. There is some evidence that the chrome cylinder failures resulted from faulty chrome plating techniques.

Other than these two problems, this series turbocharged engine has an excellent maintenance record. From a combustion standpoint, the maximum load carrying ability of the engine has not been reached. This is true even though at one time a gas load of 2,400 bhp was accidentally imposed upon the engine for short duration. Just how much load the new heavier engine frame will endure continuously is not known. However, it is believed that 1,800 bhp is a very conservative rating. Figure 3 is a view of the turbocharger which is mounted above the engine flywheel. Figure 9 is a view of the combination scavenging air filter-humidifier. The principle of this unit, which is called an aquatower, will be discussed later.

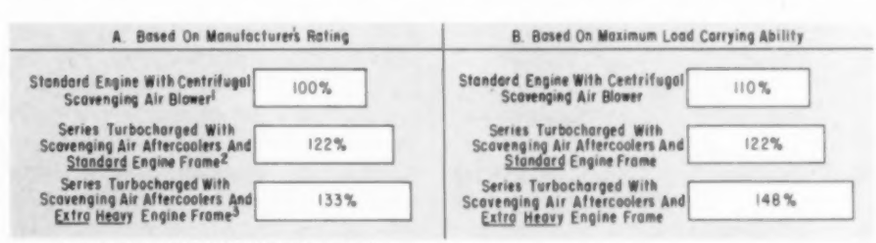
Advantages of the series turbocharged 14 x 14 V-angle compressor unit are as follows:

1. High overload capabilities.
2. The engine can be operated at relatively high exaluations (up to 7,500 feet) without derating the engine horsepower.
3. Low installation cost per horsepower, because as the horsepower rating of a given size unit is increased, some of the installation costs remain fixed.
4. High engine efficiency, which means relatively low fuel consumption. One of the reasons that engine


A. Builder's Rating
Conventionally Scavenged Engine
100%
Positive Displacement Blower Driven By A V-Belt On A Flywheel Pulley
123%
Air Compressor Cylinder
123%
Exhaust Driven Blower With No Scavenging Air Cooling
123%
Exhaust Driven Blower With Air Precooling And Aftercooling[1]
136%
B. Engine Load Carrying Ability
Maximum Continuous Load Carrying Ability Of Conventionally Scavenged Engine
113%
Positive Displacement Blower Driven By V-Belt On A Flywheel Pulley
123%
Air Compressor Cylinder
129%
Exhaust Driven Blower With No Scavenging Air Cooling
150%
Positive Displacement Blower Driven By Electric Motor[2]
150%

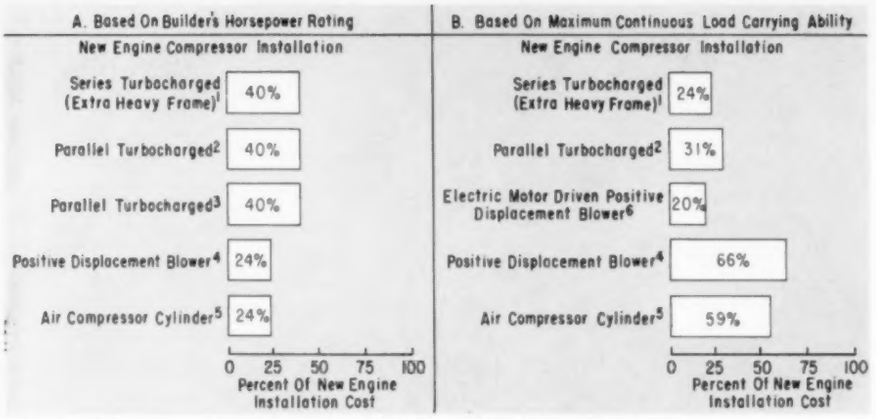
1. No Field Testing Experience With This Type Scavenging Arrangement With Cooling.
2. This Arrangement Was Not Furnished By The Manufacturer Of The Compressor Unit.

FIGURE 4—Gains in maximum continuous load carrying abilities of parallel supercharged compressor engines as compared to a conventionally scavenged engine.


A. Based On Manufacturer's Rating
Standard Engine With Centrifugal Scavenging Air Blower[1]
100%
Series Turbocharged With Scavenging Air Aftercoolers And Standard Engine Frame[2]
122%
Series Turbocharged With Scavenging Air Aftercoolers And Extra Heavy Engine Frame[3]
133%
B. Based On Maximum Load Carrying Ability
Standard Engine With Centrifugal Scavenging Air Blower
110%
Series Turbocharged With Scavenging Air Aftercoolers And Standard Engine Frame
122%
Series Turbocharged With Scavenging Air Aftercoolers And Extra Heavy Engine Frame
148%

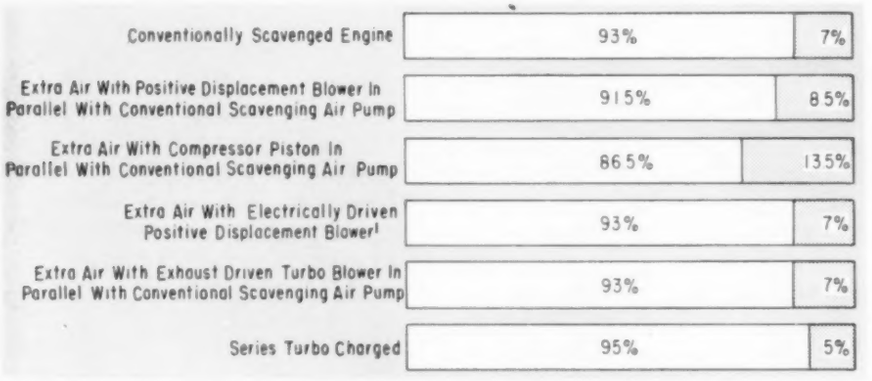
1. This Engine Rated At 135 BHP Per Cylinder
2. This Engine Rated At 165 BHP Per Cylinder
3. This Engine Rated At 180 BHP Per Cylinder

FIGURE 5—Gains in maximum continuous load carrying ability of series turbocharged 14 by 14 V-angle compressor engines.



1 Exhaust Driven Blower In Series With Existing Gear Driven Centrifugal Blower With Aftercoolers.
2 Exhaust Driven Blower In Parallel With Conventional Scavenging Air Pumps.
3 Exhaust Driven Blower In Parallel With Conventional Scavenging Air Pumps With Precooler And Aftercooler.
4 Positive Displacement Blower, V-Belt Driven From Flywheel End Of Engine, In Parallel With Scavenging Air Pumps.
5 Air Compressor Cylinder In Parallel With Conventional Scavenging Air Pumps.
6 Blower In Parallel With Scavenging Air Pumps (Setup Was Not Supplied By The Manufacturer Of The Engine).

FIGURE 6—Cost per horsepower of supercharging existing two-cycle compressor engines versus new engine installation.



Note: Shaded Area Represents Scavenging Air Compression Parasitic Load On Engine
1 Blower Requires 100 BHP Electric Motor Fully Loaded Or The Equivalent Of 6% Of Total Compressor Gas Load

FIGURE 7—Comparison of scavenging air horsepower loads of various engine scavenging combination based on manufacturer's rating.

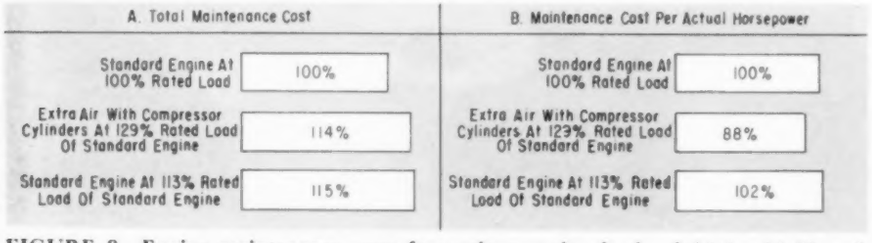

A. Total Maintenance Cost
Standard Engine At 100% Rated Load
100%
Extra Air With Compressor Cylinders At 129% Rated Load Of Standard Engine
114%
Standard Engine At 113% Rated Load Of Standard Engine
115%
B. Maintenance Cost Per Actual Horsepower
Standard Engine At 100% Rated Load
100%
Extra Air With Compressor Cylinders At 129% Rated Load Of Standard Engine
88%
Standard Engine At 113% Rated Load Of Standard Engine
102%

FIGURE 8—Engine maintenance costs for various engine loads of 14 by 14 V-angle compressors.

efficiency increases is because the specific rating has been increased by raising the detonation load limit, and the engine mechanical friction remains almost constant, thus the mechanical efficiency has been improved.

5. Relatively low scavenging air parasitic load on the engine.
6. Scavenging air aftercoolers are easily adapted to the system.
7. Space required for a given amount of horsepower is relatively small.

At the present time we are operating four of these series turbocharged 14 x 14 V-angle compressor units. One of the units has been operated satisfactorily at gas loads of 1,800 bhp or higher for about 27,000 hours.

Figure 4 summarizes the bhp gains we have experienced with these engines which were originally equipped with conventional scavenging pumps only. The gains shown in Figure 4-A are based on manufacturer's bhp output rating, while those listed in 4-B are based on maximum continuous gas loads at which our engines have successfully operated during periods when ambient air temperatures were at, or near 100° F. The one exception to this is the parallel turbocharged engines which have been tested under gas loads as high as 179 percent of rating before supercharging but have not been operated continuously at loads higher than manufacturer's supercharged rating.

Figure 5 presents the gains in maximum load carrying abilities of **series turbocharged** 14 x 14 V-angle compressor units. These engines were originally equipped with a gear driven centrifugal blower only.

Before making a decision as to what maximum continuous bhp load to which the series turbocharged engine should be subjected, the manufacturer should be consulted. His records will indicate which engine frame you have—standard frame or the new stronger frame. **The present recommended maximum loading for the standard frame of the 14 x 14 V-angle unit is 165 bhp per power cylinder. Maximum continuous load limitation of the new stronger designed frame is not known.**

The per horsepower cost of supercharging existing engines is considerably less than the per horsepower cost of installing additional new engines. Figure 6 indicates the savings we have experienced.

Figure 7 presents the parasitic scavenging air compression bhp load on the engine for the various ways of which our engines are scavenged. We have no units that are totally scavenged by a turboblower. It is worth noting, however, that a turbocharged unit of this type utilizes only waste heat energy to do the scavenging work. Consequently, no parasitic scavenging air compression load is placed on the engine.

Figure 8 graphically presents a comparison of total unit maintenance costs developed from a survey made on three separate compressor stations, each operating under different load conditions. Except for the method of scavenging air compression, engines at each station are identical. Figure 8B presents a comparison of maintenance costs per horsepower. Generally we have found that the per horsepower (actual) maintenance cost is lower for the engines operating at higher loads.

Figures 9 and 10 show the combustion air cooling system used on the series turbocharged engine.

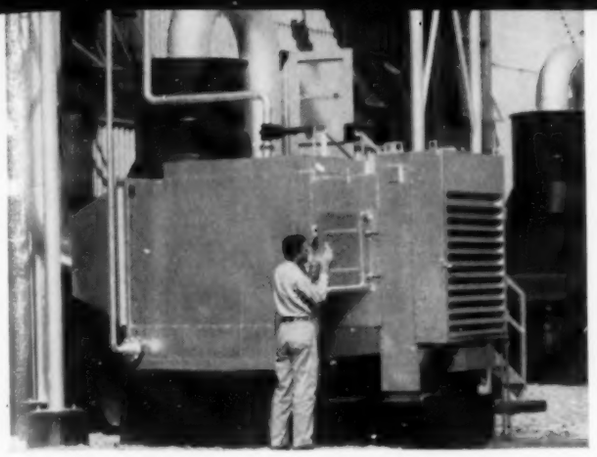
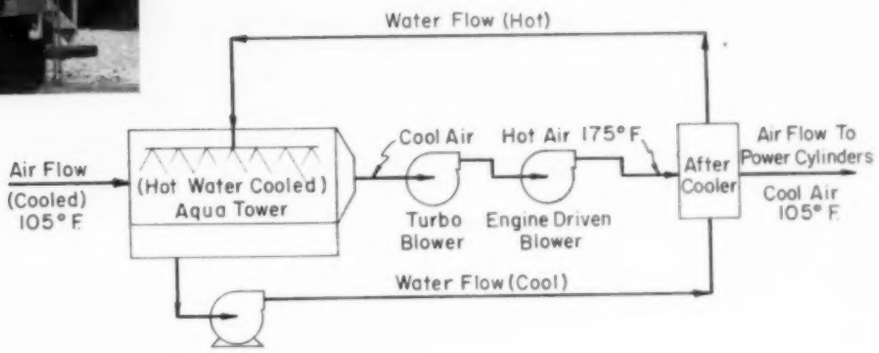


FIGURE 9—(left) Combination scavenging air filter-humidifier. For a discussion of principle, see text. For diagram, see Figure 10 (below).

FIGURE 10



This system has some of the attributes of the old shell game. There is some heating being done and some cooling being done but the total heat energy input to the engine by the scavenging air system is not significantly changed because of the precooler (aqua-tower) and aftercooler. It is a closed system. Hot water from the aftercooler either warms or cools the air coming into the spray chamber, depending upon the ambient dry bulb temperature. The wet bulb temperature of the air is raised and the water is cooled. This cool water is then used to cool the air after compression. It appears that the water is absorbing heat but never rejecting any. Where does the heat due to compression of the air go? Which shell is the pea under? These questions can be answered by examining the function of each component in the system and making a qualitative heat balance around the whole system.

The spray chamber is the first component of the system that deserves attention. The relatively dry air coming into the spray chamber evaporates some of the water and the water is cooled as a result. Likewise, if the dry bulb temperature of the air is sufficiently above the temperature of the cooled water, it also is cooled. Heat has been added to the system—none has been removed.

The air is then compressed in two stages of compression, first in the exhaust driven turobcharger, then in the engine driven blower. Since the compression is approximately isentropic, the air is raised to a hot 175° F. Certainly no heat was removed by this component.

Examine carefully the last component, the aftercooler. It is cooling the air from 175° F. to about 105° F. But the aftercooler is not removing the heat from the system either because every btu is takes from the air at this point, it puts back into the system at the spray chamber.

It seems doubtful if at this point much has been done toward a perfectly clear and lucid explanation of where the heat of compression is going. All Magnolia has done is peep under three shells and found that the pea isn't under any of them. But as in all shell games, there is a little hole in the table through which the pea can fall. In this case, it is the air leaving the aftercooler. The air is carrying the amount of water vapor it had when it entered the spray chamber plus the amount evaporated in the spray chamber, minus any amount condensed in the aftercooler. The heat energy generated by compression is still in the air-water vapor mixture, only it manifests itself as the latent heat of the evaporation of water and the difference in sensible heat of the air at the ambient temperature and its temperature downstream of the aftercooler.

From the foregoing explanation, it is apparent that essentially all the heat due to compression of the scavenging air is going to the power cylinders. So it is not heat but temperature that has such a pronounced effect upon detonation.

All five methods of supercharging existing engines gave significant increases in the load carrying ability. In each case the installation cost per horsepower was less than the unit horsepower cost of the new engines. While total maintenance costs increased as a result of supercharging, these costs were generally less proportionally than the increase in horsepower. Selection of the method of supercharging requires a study of operating and maintenance cost, horsepower required, engine design, fuel requirements, and parasitic load, as well as initial investment.

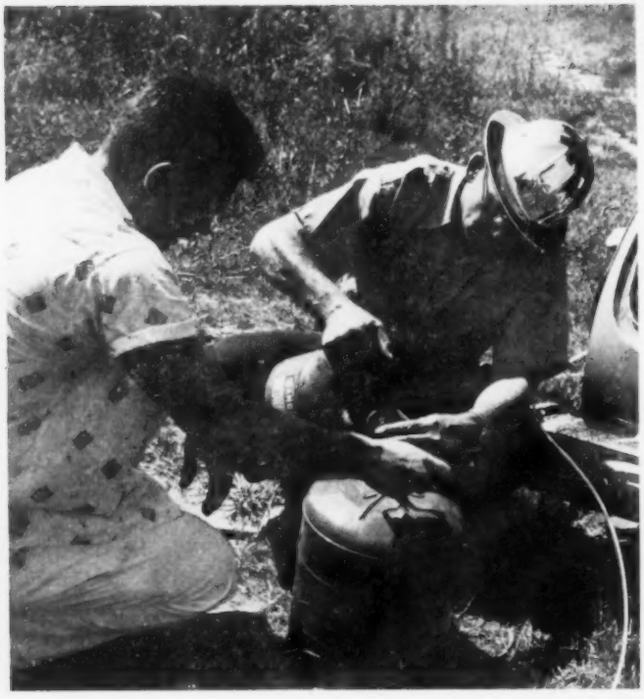
—The End

About the Authors

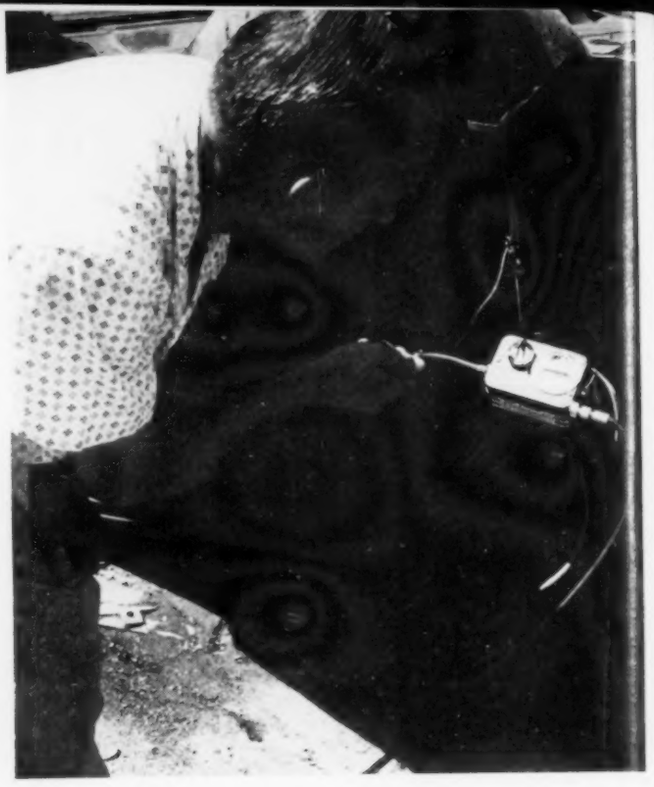
Bolfing Todd

R. G. Bolfing graduated from Texas A. & M. College in 1949 with a B.S. degree in mechanical engineering. He went to work immediately in the Natural Gas department of Magnolia Petroleum Company and spent the next three years in the field. He moved into the Dallas office in 1952; for the past 6½ years he has headed the Maintenance Engineering section.

J. F. Todd has been in the Natural Gas Department of Magnolia Petroleum Company since 1950. For the past two years he has been engaged in mechanical operation and maintenance engineering problems. Todd graduated from Stanford University in 1949 with a B.S. degree in mechanical engineering. He worked a year for Continental Supply before joining Magnolia. During World War II, Todd was a diesel mechanic in the U.S. Navy.



Filling the "safety can" that can fill the trunk of an automobile with explosive gasoline fumes on a hot summer day. Cap may permit escape of vapors within a few seconds.



Installing an explosimeter that measures vapor concentration. In this case, the heat of the sun produced a dangerous mixture in less than three minutes!

How to Turn Your Automobile Into a

Just fill a five-gallon safety can with gasoline; store it in the trunk of your auto on a hot day. Push the transmitter button on the car radio—As you sail through the air, you may conclude, "Safety Cans—Aint!"

TIME WAS when a potato was the normal and accepted stopper for the spout of a five-gallon can. It was just as natural to cork up five gallons of gasoline with a small Irish potato as it was to buy striped candy in a paper sack.

But the price of potatoes rose, taking them off the can stopper market—so-to-speak—and someone came along with a five-gallon "safety can."

Remember the first time you ever saw one of these innovations? The can was painted a bright red—just dandy to absorb heat from the sun—and it had a spring loaded cap on the spout that was said not to leak—under any conditions!

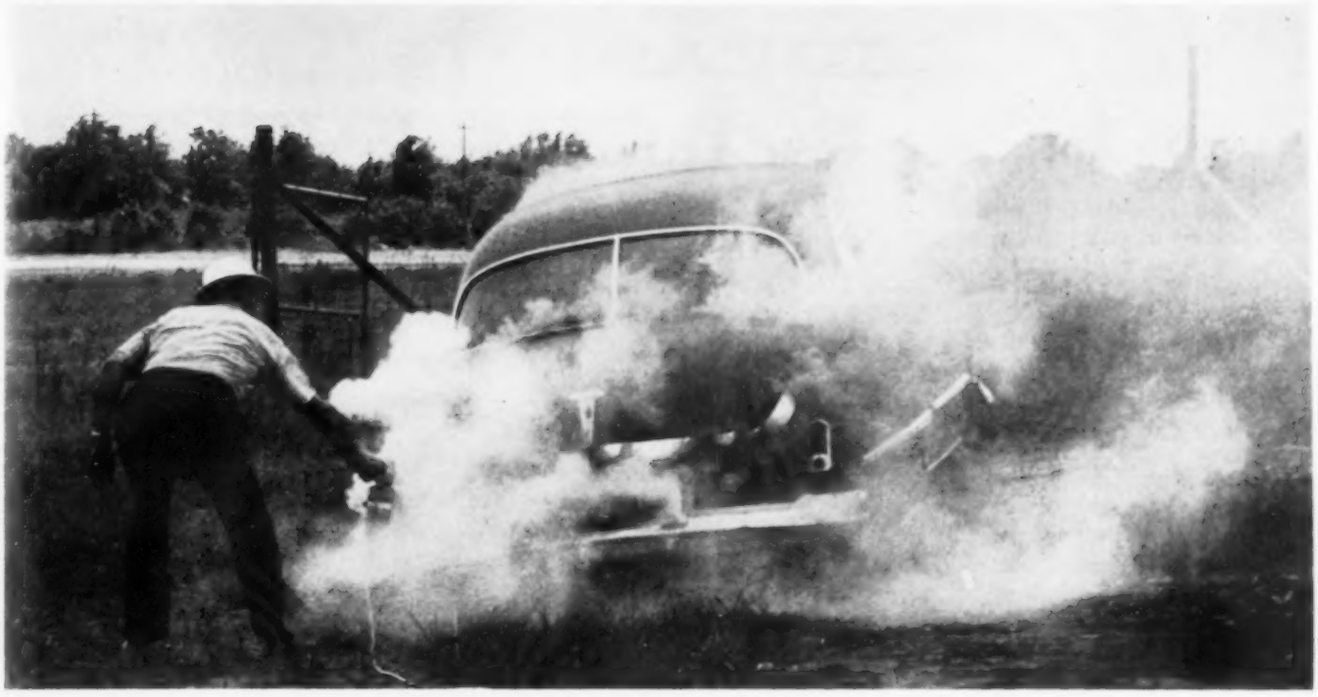
And because it was called a "safety can" no one ever bothered to question its merit. The myth sprang up that you could safely transport extra gasoline in your automobile—*if you used a "safety can!"*

This myth was *exploded* five times in one afternoon not long ago by two Service Pipe Line Company safety men. In fact, Holly Bradley and Sylvan Starks not only exploded it—they blew it all to smythereens!

They proved that a dandy way to make a time bomb is to store gasoline in a *safety can* inside the trunk of an automobile. The can with its spring-loaded spout leaks vapors, and when the air-vapor ratio gets just right, any spark will touch off one whale of an explosion. The spark could come from a switch or relay in a radio transmitter, the electric motor of a gager's centrifuge, or a simple short-circuit in the tail light wiring of a car.

Bradley and Starks spent two years running down facts on this hazard. Accidental explosions of this type have happened, but the trick was to make one happen under controlled conditions.

Bradley and Starks did just that. They bought an old automobile from a salvage yard, hauled it to a safe area and started their tests. Earlier experiments had proved that when a closed *safety can* was subjected to heat, expansion of the fluid inside would build



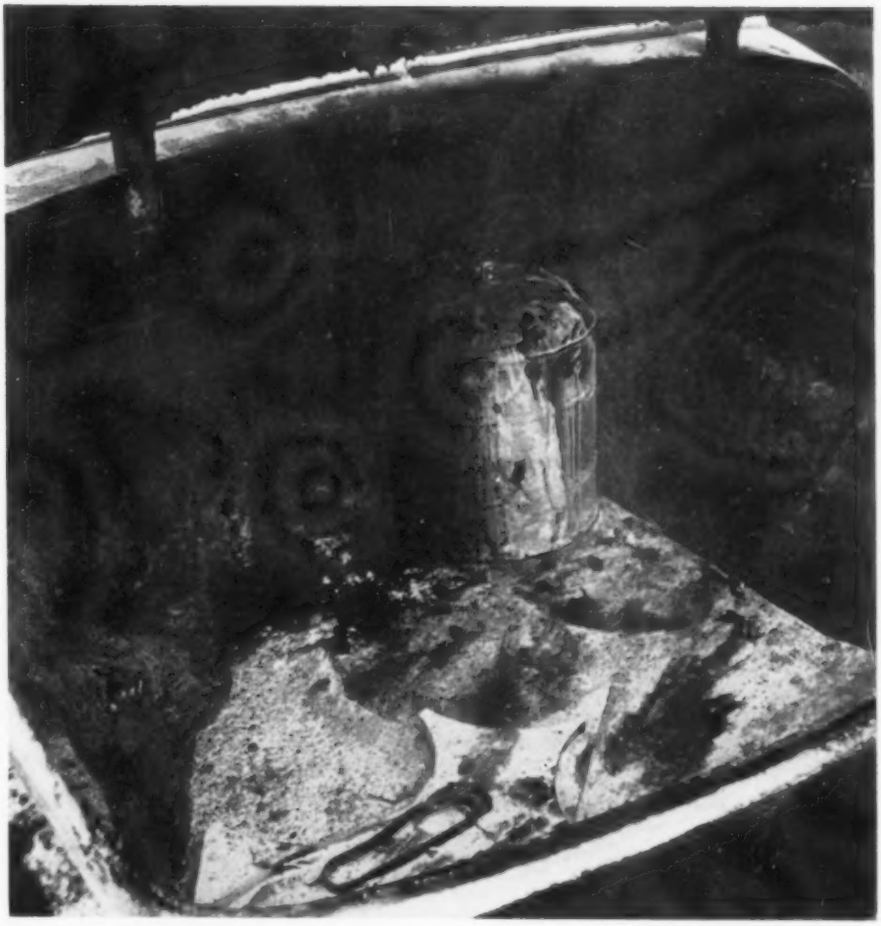
Ba-a-looie! After the explosion safety engineer approaches automobile to extinguish flames.

Time Bomb!

up enough pressure to force vapors out past the cap. In a sealed compartment—such as an automobile trunk—the vapor would ultimately reach explosive proportions.

The two men proved this is quite likely, and it's a cinch to set off such an explosion. In their experiments they set off five explosions with flint and steel lighters, activated remotely with a copper wire. After each explosion, the men would hasten to the battered stern of the auto, put out the fire and survey the results.

Bradley and Starks proved that in hot sun, it required only three minutes for an explosimeter to register dangerous mixtures in the trunk. The longer the ignition was delayed, the greater the resulting explosion. Bradley stopped far short of the maximum explosion that would occur if the trunk were saturated—a blast that would destroy a car and, under normal conditions, very likely kill or seriously injure the driver and passengers.



What was in the trunk after the fire. "Safety cans" can be dangerous!

The fault of the cans—which many experts thought safe—was proved beyond any doubt. So the next time you see someone fill a *safety can*, stow it in the trunk of their car—you might either warn the driver or get the heck away from his bomb! —**The End**

By Pipe Line Pete

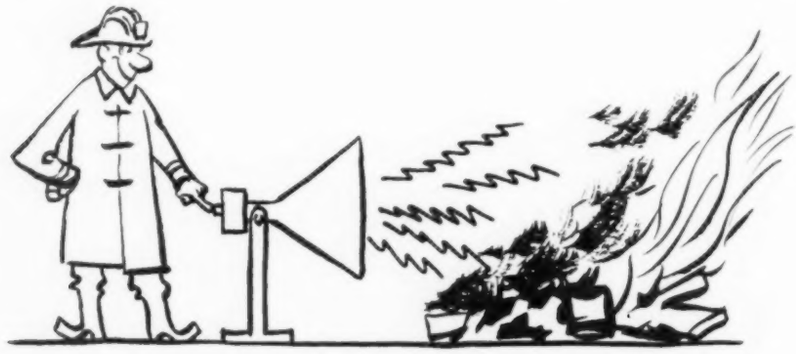
IDEAS FOR THE FUTURE!

... in pipe line engineering, construction and operations

Advances in Sound—Acoustic Fire Extinguisher Is Coming!

A new method of producing sound—not by mechanically vibrating elements, but by the pressure of ions created in a high-frequency corona discharge—may mean that we soon will be putting out fires with a blast of sound! The same medium may be used to clear airport runways of fog.

This new method of producing noise was discovered by a French inventor and introduced into the United States by the Institute of Inventive Research.



Researchers are making progress toward development of such varied applications as the acoustic fire extinguisher (Southwest Research Institute's Fire Technology Division is working on this one), an improved rail crossing signal, and an instrument for measuring high transient pressures from explosions.

In addition, this new sound source is being investigated for applications in the field of communication engineering.

Pipeliners will probably see a number of applications in the near future.

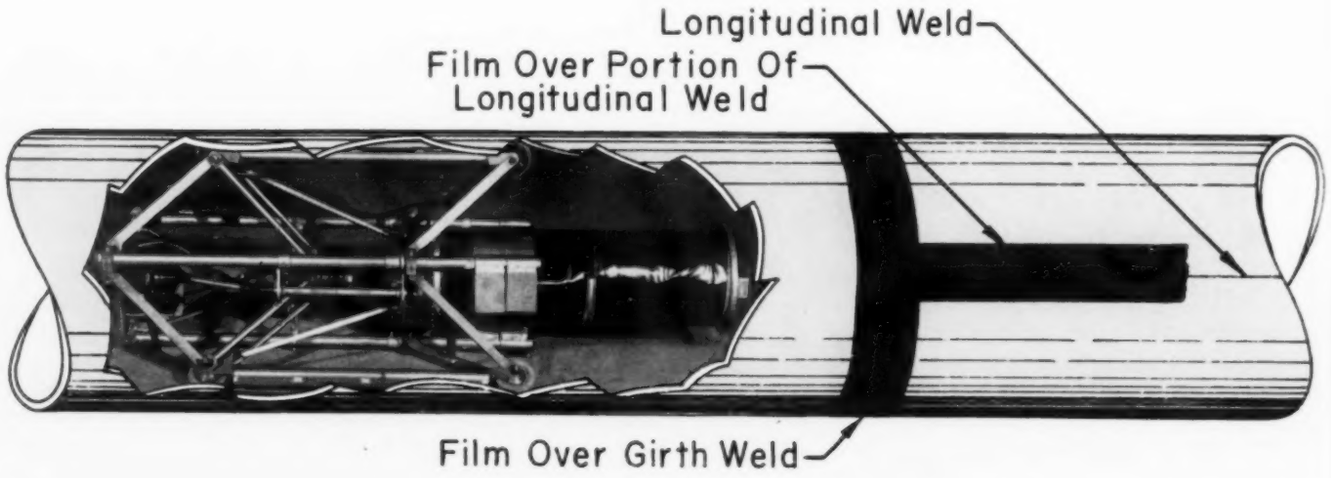
Traveling X-Ray Cuts Cost, Eliminates Back-up Strip

A traveling X-ray machine that produces a ¼-inch wide, 360-degree continuous beam—composed of parallel rays—makes it practical to X-ray longitudinal and girth welds on the right-of-way.

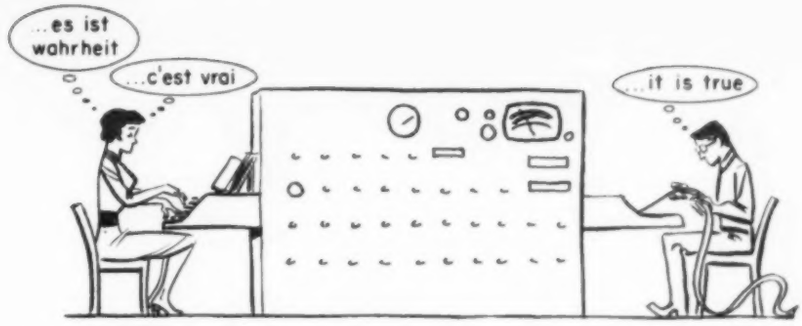
The device can traverse 3,000 feet of welded-up pipe X-raying every single foot of it. However, only the portions that have film over them will be recorded. The machine has six drive wheels and drags its power supply cable behind it.

One of the most exciting features of this method is the elimination of the heavily shielded back-up strip for film. Because the X-rays are parallel, no distortion occurs when film is placed on the pipe in light-proof envelopes.

Also there are no switches necessary to actuate the machine. It produces X-rays continuously as it travels the pipe, making a 40-foot joint every 55 seconds.



Just Imagine!



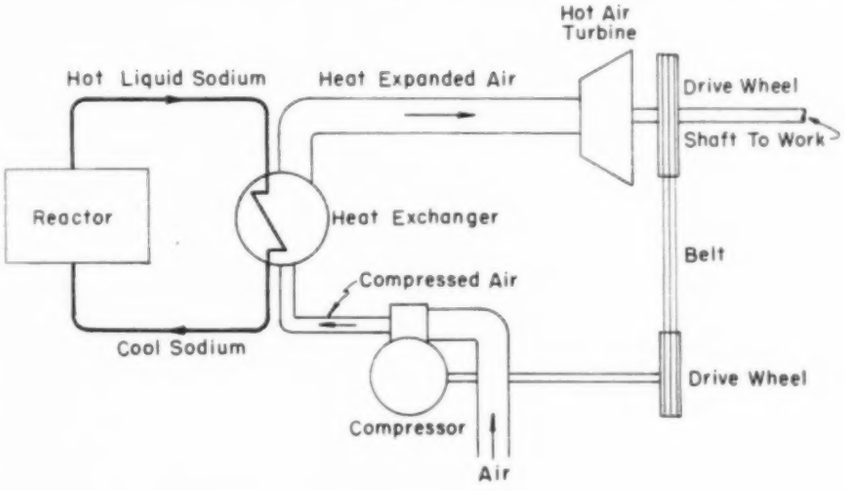
Computer that translates languages. IBM's 794 is translating French technical papers into fairly smooth readable English. The machine can be converted to translate Chinese, Russian or Arabic.

Electron welding in a high vacuum. Air Reduction's research laboratory has developed the new welder to join exotic metals such as beryllium, molybdenum, etc. It produces a beam about 1/16-inch in diameter.

Coal-burning gas turbine is under study by BuMines research group. The objective—to utilize vast deposits of coal in New Mexico to generate low-cost power.

Lightweight tracked vehicle called the "Rat" will climb 80 percent grades where the turf is good. Canadian Ltd.'s new tractor-trailer will scramble up 60 percent grades covered with snow—carrying a 1,000-pound payload! Gross weight—2,500 pounds; turning circle, 22 feet. A 4-cylinder, air-cooled engine drives the vehicle 3 miles per hour on water, 20 mph on land!

Hot-Air Turbine May Be Powered By Nuclear Heat



A hot-air turbine in the 1,000 hp class will be investigated by Clark Bros. Co., a division of Dresser Industries. The U.S. Army has awarded Clark a contract to perform the necessary feasibility studies.

As proposed, the unit would be used as a portable electric power generator. A small-sized, sodium-cooled reactor capable of high thermal output supplies the energy. A pump circulates liquid sodium through a heat exchanger where air from the turbine's compressor is heated and expanded. This expanded air provides energy to drive a generator as well as the turbine's compressor.

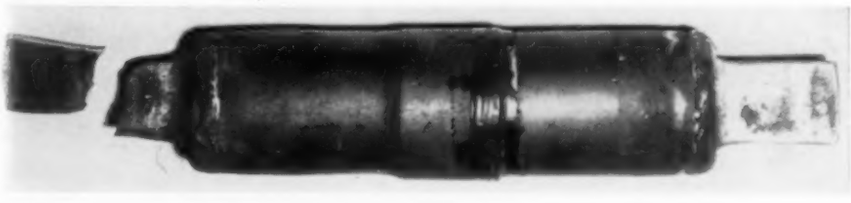
Holiday-Free Internal Coating Points to New Economies

A holiday-free internal coating, made up of four different kinds of plastic compounds may mean that steel tonnage in many gathering systems will be reduced in the future. The coating, which will withstand almost every conceivable corrosion attack is manufactured and applied by a Houston firm.

The explanation for the lack of holidays is the method of application. First, the coating mixture is composed of 100 percent total solids—meaning no solvents or carriers are mixed with the compounds to spread them into place. Second, special equipment spreads the raw plastic mixture evenly throughout the pipe as it spins at speeds approaching 5,000 rpm—depending on the diameter, etc.

One of the far-reaching aspects of the new coating is that it eliminates the need for thick walls on a portion of the small diameter pipe. In the past, a good portion of the steel in lines 4 inches in diameter and smaller has been needed to guard against pitting. In other words, a 2-inch pipe with ⅛-inch wall thickness will withstand pressures in the order of 4,000 psi. However, a single pit—penetrating ⅛ of an inch—will cause a leak.

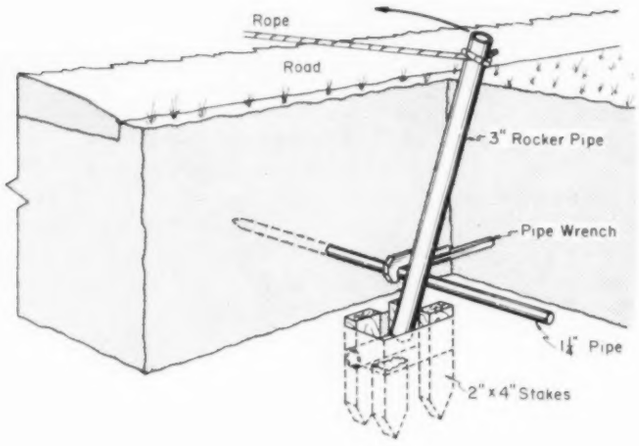
One of the tubings distributed is thin-wall bell and spigot ends. When glued together, this pipe will withstand pressures ranging from 900 psi to 2,000 psi. The strength of this joint is graphically illustrated in the photo. Note that one of the coupons welded to the pipe has pulled in two and the bell and spigot joint remains intact. The pipe is 3-inch thin-wall flow line. The savings in this instance is quite high.



How to do it

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas



Simple Method For Crossing Under Roads with Small Pipe

Here's a method of crossing beneath roads with conduits or small pipe that can save hundreds of dollars every time it's used. It requires little or no special equipment: the most costly item is a road-width string of 1¼-inch pipe, threaded and coupled every 10 feet.

Essentially, the method works this way: The string of 1¼-inch pipe with a sharpened point or "guide shoe" is jacked beneath the road by three men using a rocker post and a Stilson wrench. Once through, the 1¼-inch is used to thread a ¾-inch wire rope beneath the road as it is withdrawn from the pilot hole.

A winch truck successively pulls cutting plugs back and forth through the hole, enlarging it each pass. When the hole has been cut to the proper size, the casing is pulled beneath the road.

Tools. The rocker post is nothing more than a 10-foot length of 3-inch pipe teed into a 14-inch length of the same pipe. Aside from the pointed shoe and the 1¼-inch string of pipe, the remaining tool used in the jacking operation is an 18-inch Stilson wrench.

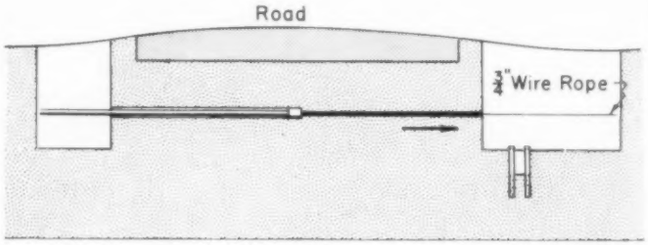
Jacking beneath the road. The first step is to dig the approach ditches on either side of the road. They should be a foot or so deeper than required next to the road. The reason? Laying specifications specify minimum cover—not maximum. An extra foot or so may save rejacking the pilot hole, should it be deflected slightly upward.

About one foot from the end of the ditch where the tunneling is to start, cut a narrow cross trench for the rocker post tee. This acts as pivot point for the rocker, and if the soil is loose, 2 x 4 stakes should be driven into the bottom of the ditch to give the rocker post additional reactive purchase.

One worker in the ditch starts the point of the 1¼-inch pipe beneath the road. Roughly, this runs about 6 inches to one foot above the ditch bottom and at least 6 inches below the center-line of the final pipe line crossing. Two workmen at the surface pull the rocker post back and forth as the man in the ditch works the Stilson wrench in rachet fashion as shown in the illustration.

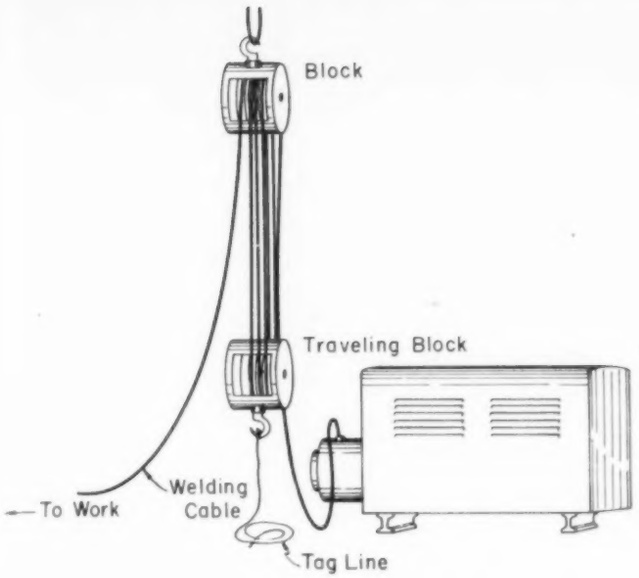
Each time the pointed shoe on the 1¼-inch pipe progresses 10 feet, another 10-foot length of pipe must be made up onto the end until the span is complete.

When the pipe reaches the opposite side of the road, the guide shoe or nose, is removed and a wire rope socket is made up on the pipe. Next, the 1¼-inch pipe is jacked backwards, using the same rocker post and Stilson wrench; as it comes from the hole it is pulling a ¾-inch wire rope from the opposite side.



Once the ¾-inch wire rope has been threaded through the pilot hole, it is connected to the drum of a winch truck. This truck pulls cutting plugs back and forth through the hole, enlarging and cleaning it with each pull, until it reaches the proper size to accept the casing.

There are several limitations on this method. First, it will not be successful if rock is encountered beneath the road. Second, the size hole that can be reached by pulling plugs back and forth, is probably limited to something like 12 or 14 inches for practical purposes—at least this is the largest size holes made by the method so far as the editors of PIPE LINE INDUSTRY know. Where the method is applicable, it can result in a great savings in time and money.



Store Welding Cable As Line On Light Five-Sheave Block

One of the problems besetting the pipe line maintenance welder is the wear and tear on his welding leads inside the plant warehouse or shop. Everything from trucks to wheelbarrows run over them, causing shorts.

Here is a simple solution. Simply leave the welding leads up between two light, five-sheave blocks. When slack is needed, as when making a weld at the far end of the shop, the welding leads are pulled and the bottom block rises. After the weld has been made, simply pull down on the tag line and the welding cable will be taken up between the blocks.

The cost of this storage system is little. In fact, the entire cost will be that of the cost of the two light blocks, and the lighter they are, the better.

Portable Pipe Straightener Used For Light Field Work

Here is a prize timesaver for use where short lines are reclaimed and reconditiond in the field. On small jobs, joints can be run through the straightener as it is racked or loaded out without having to send "dog legs" to a yard.

The straightener is loaded on a two wheel auto trailer in such a way that the dollies on the trailer are level with the pipe racks. When it is necessary to straighten or bend pipe in the field it can be quickly towed to the field site either by pickup or car.

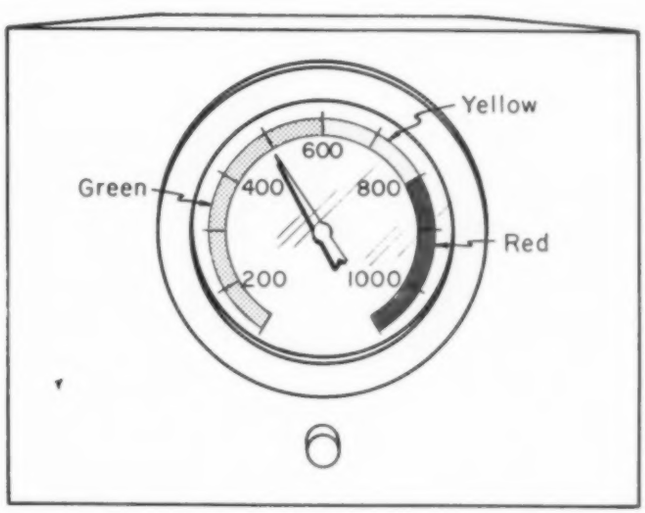
Temporary racks that hold the pipe to be straightened are made from small size pipe; these are supported on triangular stands which telescope together to make a compact load. Stands are adjustable for level racking of pipe even on rough ground.

Colored Tape Designates Range on Instrument Faces

If you've ever visited the cockpit of an airplane, you've seen the way color is used to tell the pilot at a glance which instruments are reading, high—which instruments are reading low. This same idea will prove effective in a modern pipe line pump station which is highly instrumenized. Here's the way it's done.

Using three colors of pressure sensitive tape, divide the travel of the instrument pen or indicator into three operating ranges. Normal range is designated with a circular strip of green tape; the "caution" zone is designated with yellow tape; and the "danger!" zone is designated by an arc of red tape.

Stick the tape on the inside of the instrument glass face cover, and it will last almost indefinitely.



Rules of Thumb

and Engineering Data Sheets for the Pipeliner's field notebook

$25 for Engineering Data Sheet $15 for Rule of Thumb

These practical aids give quick, reasonably accurate answers to design, maintenance and cost estimating problems. PIPE LINE INDUSTRY will pay $25 for each chart, nomograph or data sheet published—$15 for each Rule of Thumb. Send your ideas to PIPE LINE INDUSTRY, P. O. Box 2608, Houston, Texas

Engineering Design —62—Estimating Comparative Capacities of Gas Pipe Lines.

To estimate capacity of one diameter line in terms of another read downward in the appropriate column to desired diameter line. Example: A 24-inch (23.375-inch ID) pipe line has a capacity 160 percent that of a 20-inch (19.500-inch ID) line.

This chart is based on diameter factors using the Panhandle equation. Equivalent inlet and outlet pressures, lengths of line section, and uniform flow are assumed for both lines.

(Figures give capacity of one diameter pipe as percent of another.)

	Nominal Diameter	36″	34″	30″	26″	24″	24″	20″	18″	16″	12¾″
Internal Diameter		35.250″	33.250″	29.3125″	25.375″	23.375″	23.000″	19.500″	17.500″	15.500″	12.250″
35.250″	36″	100	85.7	62.7	43.6	35.2	33.7	22.0	16.5	12.0	6.5
33.250″	34″	116.8	100	73.1	50.8	41.0	39.3	25.7	19.2	14.0	7.6
29.3125″	30″	159.7	137	100	69.6	56.1	53.8	35.7	26.3	19.2	10.4
25.375″	26″	229	197	149	100	80.7	77.5	50.2	37.8	27.6	14.8
23.375″	24″	285	244	178	124	100	96.0	62.3	46.9	34.2	18.5
23.000″	24″	298	255	186	129	104	100	65.1	49.0	35.7	19.2
19.500″	20″	458	392	287	199	160	154	100	75.3	55.0	29.6
17.500″	18″	608	519	379	264	213	204	132	100	73.2	39.3
15.500″	16″	835	715	522	363	293	281	182	127	100	53.8
12.250″	12¾″	1545	1322	968	673	543	521	338	254	185	100

Miscellaneous —37—How to estimate the water content of a mixed gas stream

RULE: Divide the volume of each of the component gas sources by the total line volume and multiply by the water content (in lbs. per MMcf) of that particular gas source. Add the totals thus obtained to find the total water in the pipe line (lbs. per MMcf).

Example: If a pipe line is flowing 400 MMcf per day and this volume is made up of the following component gas streams:

75 MMcf with a water content of 5.2 lbs. per MMcf
60 MMcf with a water content of 18.4 lbs. per MMcf
150 MMcf with a water content of 9.1 lbs. per MMcf
115 MMcf with a water content of 2.5 lbs. per MMcf

—Find the average water content of the pipe line.

Solution: Find the water content of the partial volumes:

$$\frac{75}{400} \times 5.2 = 0.975$$

$$\frac{60}{400} \times 18.4 = 2.76$$

$$\frac{150}{400} \times 9.1 = 3.4125$$

$$\frac{115}{400} \times 2.5 = 0.7188$$

$$7.8663 \text{ lbs. water per MMcf flowing in line.}$$

WHAT'S HAPPENING

IN PIPE LINE CONSTRUCTION

By Donald G. DePugh, Construction Editor

Midwestern Files Application To Import Canadian Gas

Midwestern Gas Transmission Company has filed an application with the FPC seeking permission to supply gas to the upper Midwest area.

In its application, Midwestern proposes to construct a 504-mile, 24-inch line from a point on the Minnesota-Canada border south of Winnipeg to Marshfield, Wis. The line will take 200 MMcf of gas daily from TransCanada's line and tie-in with Michigan Wisconsin Pipe Line Company's proposed facilities near Marshfield.

Approval from Canadian authorities for export of gas and FPC for importation will be necessary before the $52 million project will be built. Construction is planned for 1960.

Atlantic Seaboard Lets Two Contracts in West Virginia

Atlantic Seaboard Corporation has let contracts on 58 miles of 30-inch gas lines in West Virginia. A 43-mile section has been awarded to Williams Brothers Company and the 15-mile portion will be laid by H. L. Gentry Construction Company.

East Coast Plans Products Line to Long Island Area

East Coast Pipeline Company is planning a 12 to 24-inch products line approximately 90 miles long from Linden, N. J., across Staten Island, under the Narrows and extending to a terminus in Suffolk County, N. Y.

The 300,000-barrel capacity line would deliver fuel oil and aviation gasoline with delivery points at La-Guardia and Idlewild airports, Long Island City, Inwood, Island Park, Bethpage and localities in Queens, Nassau and Suffolk counties.

Construction of the $27 million project will be along the right-of-way of the Baltimore and Ohio Railroad on Staten Island. New York City's Board of Estimate and the U.S. Army Corps of Engineers have approved franchise for crossing the Narrows, according to East Coast Pipe Line Company.

Texas Eastern Little Big Inch Division Begins Work on LPG Storage Reservoir

Texas Eastern Transmission Corporation has begun construction on a 1 million-barrel capacity LPG underground storage reservoir at Barbers Hill, Texas, near Houston. This is the first of two identical wells to be drilled in the salt dome. Both wells will be completed by September.

The well will be drilled to near 4,000 feet and fresh water will be used to wash out a cavity. Texas Eastern will use 36-inch casing from the surface to a depth of 160 feet, 30-inch casing will extend to the cap rock, about 500 feet below surface. A 13⅜-inch products string will be lowered 2,000 feet and an 8⅝-inch water string will be extended to the bottom of the well. The water line will be inside the products carrier.

Propane will be displaced by pumping water into the well; when propane is pumped into the reservoir, water will be pushed out. Texas Eastern will install two 500-hp centrifugal pumps to pump water which comes from a nearby canal. Two 700-hp booster pumps will be used to inject propane.

Included in the Little Big Inch $2 million project is a 10-mile, 12-inch reversible products line from Baytown to the reservoir, a 2,500-foot, 16-inch water line to the canal, and a 5,000-barrel water storage tank.

Alberta Gas Lets Contracts On Main Line and Laterals

Alberta Gas Trunk Line Company, Limited has awarded contracts to Mannix Co., Ltd., and Marine Pipeline and Dredging, Ltd., on over 200 miles of main line and laterals.

Mannix will lay 122 miles of 30-inch main line extending from near Princess to Torrington, Alberta, Canada. Marine Pipeline and Dredging will construct two 16-inch laterals; a 46-mile line from Torrington junction to Nevis, Alberta, and a 33-mile section from Torrington junction to the Carstairs area, Alberta.

Construction will include a 1,000-foot crossing of the Red Deer River at Nevis. Work is underway on the $20 million project and completion is scheduled for September.

Alberta's 1959 expansion program includes several small diameter laterals; bids will be asked on these lines later this year.

Coastal Transmission Corp. Plans Expansion Program

Coastal Transmission Corporation has filed an application with the FPC for construction of new facilities costing $6.2 million.

The expansion will consist of compressor additions and lateral lines, in addition to the present system under construction from McAllen, Texas, to Baton Rouge, La. The construction program will allow Coastal to boost its gas deliveries to Houston Texas Gas & Oil Corporation to 335 MMcf daily.

Texas Electric To Build 300-Mile Intrastate Line

Plans for a 300-mile, gas pipe line from Old Ocean field to Fort Worth, are being developed by Texas Electric Service Company.

The Fort Worth firm plans to form a subsidiary to construct and operate the transmission line which would deliver a maximum of 250 MMcf of gas per day. Gas will be purchased from Pan American Petroleum Corporation and Magnolia Petroleum Company.

Construction on the $25 million line should get under way late this year and completion is expected before December, 1960.

Manufacturer's Light & Heat Lets Contract on 63-Mile Line

Manufacturer's Light & Heat has awarded a contract to Harford Brothers to construct a 63-mile, 20-inch gas line in Pennsylvania. The new line will replace 135 miles of 6-inch.

Williams Brothers Co. Awarded Several Contracts

Michigan Consolidated Gas Company has awarded a contract to Williams Brothers Company to lay 53 miles, 30-inch gas loops from Milford to Elsie, Mich.

Williams Brothers will also lay 38 miles, 24-inch from Woodbury station to Laingsburg Junction, Mich., for Consumers Power Corporation.

United Gas Pipe Line Company has let contract to Williams Brothers on 49 miles, 30-inch loop line from Lirette, La., to Lake Pontchartrain. Work is to begin soon on 20 miles, 20-inch from Muldraugh to Louisville, Ky., for Louisville Gas & Electric Company.

Work Will Begin on Shell's Long-Delayed Indonesia Line

Williams Brothers Company and John Brown, Ltd., will start work this year on a 160-mile, 20-inch, crude line in Indonesia for Royal Dutch Shell.

The line will carry crude from the Tandjung field to a refinery at Balikpapan. Plans had been stalled for years because of the problem of pumping the high-wax content crude. Shell proposes to pump the oil with 30 percent water.

Initial capacity of the line will be approximately 40,000 barrels daily with a main station at Tandjung and two booster stations on the line. Ultimate capacity is expected to be about 65,000 barrels. Cost of the project which will be completed by 1962 is $60 million.

Arabs Propose Crude Line To Mediterranean Coast

The Arab Petroleum Congress is considering plans to build a large diameter crude line from the Persian Gulf to the Mediterranean coast near Tripoli in Lebanon.

The Arab-owned line would include feeder lines from Saudi Arabia, Kuwait and Iraq to carry crude to a trunk line running to the Mediterranean coast. Cost is estimated in excess of $500 million. Initial capacity would be approximately 400,000 bpd.

Latex to Recondition Lines In Georgia for Plantation

Latex Construction Company has been awarded a contract by Plantation Pipe Line Co. to strip, lift, clean, coat and wrap, lower and backfill and spot weld, if needed, approximately 90 miles of line in Georgia, with pipe lines to remain in operating condition while work is performed.

The reconditioning includes 46 miles, 4-inch; 38 miles, 10-inch, and 7 miles of 12-inch lines.

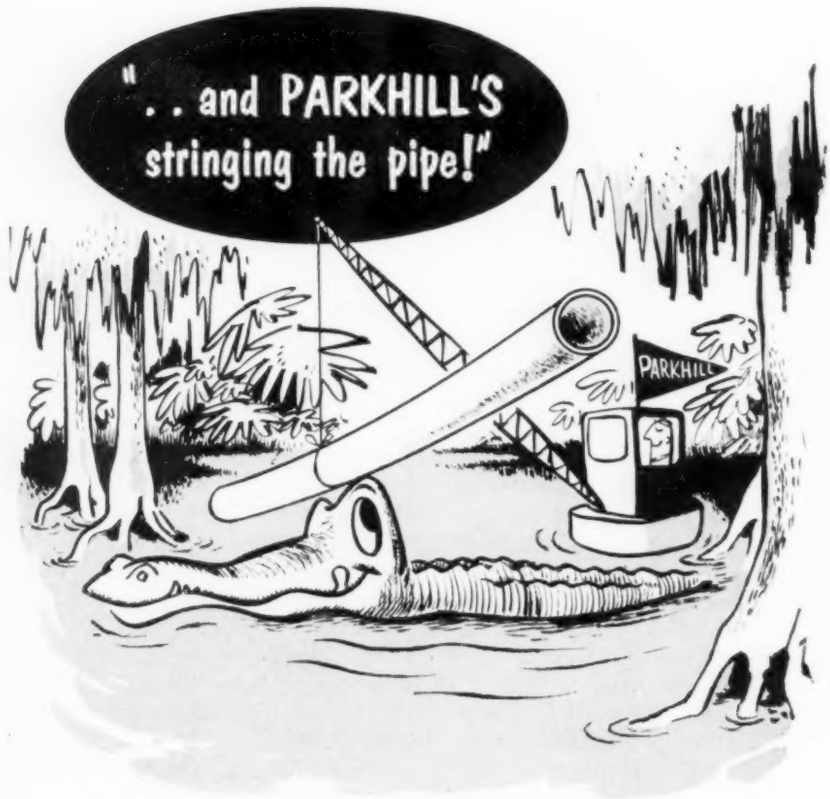
New Crude Line Is Proposed Into Central European Area

Latest plans for moving Middle East crude from southern Europe to central European points call for a 200-mile line from Venice to Munich.

The proposal, made by Aurine Alps Railway & Pipeline, includes a railway system and pipe line to be constructed on the same right-of-way. The systems would pass through a 27-mile tunnel through the Alps, about 20 miles east of Brenner Pass. Cost of the project would be $420 million.

Alex Robertson Co. to Lay 60-Mile Line for Richfield

Richfield Oil Corporation has let a contract to Alex Robertson Company for construction of a 60-mile, 20-inch line from Cuyama Valley to Ventura, Calif.



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PROPOSED PIPE LINE CONSTRUCTION

Here in convenient summary form is Pipe Line Industry's listing of company, line size, length, service, location and project status.

U. S.

Alaska Juneau Gold Mining Co., Los Angeles, 425 miles, 16-inch, gas, Oklahoma City area to St. Louis, planned.

Arkansas Industrial Pipeline Corp., Shreveport, 130 miles, 18-inch, gas, Perla-to-Helena, Ark., $9 million, planned.

Atlantic Seaboard Corp., 58 miles, 30-inch, gas, in West Virginia, contract let to Williams Brothers Co. and H. L. Gentry Construction Co.

Buckeye Pipe Line Company, New York, 70 miles, 8-inch, products, from Wayne to Flint, Michigan, planned.

Chicago District Pipeline Company, 52 miles, 30-36 inch, gas, from Natural Gas' proposed line at Joliet to Chicago, $13 million, before FPC.

Coastal States Gas Producing Co., Corpus Christi, Texas, 289 miles, 14 and 18-inch main line and gathering system, McAllen to Falfurrias, Tex., area, and Lopena to La Salle County, $12 million, contract let on 95 miles to O. R. Burden Construction Corp.

60 miles, small diameter, gas gathering line, to tie in with system under construction and extend to Pearsall County, Texas, planned.

Coastal Transmission Corp., Houston, 574 miles, 22-24 inch, gas, from McAllen, Texas to Baton Rouge, La. connection of Houston, Texas Gas and Oil plus 414 miles of laterals, $55 million, contracts let on compressor stations to Gasoline Plant Construction Corp. Contract let on main and laterals, to Oklahoma Contracting Co., O. R. Burden Construction Corp., River Construction Corporation, Parson Company, Brown & Root, Buddy Sherrod, Inc., Panama-Williams, and Barry Construction Co.

Compressor station additions and new lateral lines, $6.2 million, before FPC.

Colorado Interstate Gas Co., Colorado Springs, 140 miles, gas, Green River, Wyo.-to-Provo, Utah; 109 miles, 26-inch, Texas Panhandle to southeastern Colorado; 136 miles, 34-inch, southeastern Colorado-to-Pueblo, Colo.; 107 miles, 30-inch, Pueblo-to-Denver, $91 million, before FPC.

Columbia Gulf Transmission Co., Houston, 12.8 miles, 6 and 20-inch, gas, loop line in Louisiana, $730,000, authorized.

Consumers Power Co., 45 miles, gas, main line: from Woodbury station to Laingsburg Junction, Mich., contract let to Williams Brothers Co.

126-miles, 26-inch, gas, main, Michigan-Indiana border to Plymouth, Mich., planned.

East Coast Pipeline Co., 90 miles, 12- to 24-inch, products, Linden, N. J. to Suffolk County, N. Y., $25 million, planned.

El Paso Natural Gas Company, El Paso, 216 miles, 26 to 34-inch main line, 533 miles, 6-20-inch laterals, gas, 86,750 compressor hp; 126 miles, 30-inch main line, 266 miles, laterals, gas, 28,920 compressor hp in new and existing stations in Arizona, New Mexico and Texas, contracts let on 916 miles to R. H. Fulton & Co., McVean & Barlow, Inc., Western Pipe Line, Inc., Eastern Pipeline Contractors, and Engineers Limited Pipeline Co.

400 miles, 34-inch, Salt Lake City, Utah, to California border, planned.

Equitable Gas Company, Pittsburgh, Penn., 11.7 miles of storage pipe line and other facilities, $2,091,430, authorized.

Florida Pipeline & Storage Co., 54 miles, products, Port Everglades to Homestead Air Force Base, Fla., planned.

Gillette Pipeline Co., Cheyenne, Wyo., 103 miles, crude, from Dead Horse Creek field to Casper, Wyo., planned.

Great Northern Railway, St. Paul, 400-600 miles, 12-20 inch, crude, from Williston Basin to St. Paul-Minneapolis and Duluth-Superior areas, considered.

Gulf Pacific Pipe Line Company, 1,600 miles, 30-inch, gas, Louisiana to California border, considered.

Gulf Resources, New York, 125 miles, gas, gathering system, from Lopena area in Zapata County to a point in La Salle County, Texas, planned.

Humble Oil & Refining Company, Houston, 116 miles, gas, gathering various sizes, southwest Texas, planned.

Iron Ranges Natural Gas Co., 115 miles, gas, from Itasca and St. Louis counties along route of Mesabi range from Grand Rapids to Aurora, Minn., $5 million, before FPC.

60 miles from Duluth to Silver Bay, Minn., before FPC.

Katy and New York Central Railroads, 2500-mile, 10-12 inch, LPG, from Houston, Texas, to New York, considered.

Manufacturers Light & Heat Co., 63 miles, 20-inch, gas, in Pennsylvania, contract let to Harford Brothers.

Michigan Consolidated Gas Company, Detroit, 53 miles, 30-inch, gas, loop, from Milford to Elsie, Mich., and 20,000 hp station at Edmore, Mich., 8,000 hp. at Woolfolk station, $15 million, contract let to Williams Brothers Co.

Michigan Wisconsin Pipe Line Co., Detroit, gas line from Marshfield, Wis., to Green Bay, Wis., $41 million, planned.

Midwestern Gas Transmission Co., Houston, 350 miles, 30-inch, gas, Portland, Tenn. to Joliet, Ill., $50.8 million, before FPC, 350 miles, 24-inch, gas, from Minnesota-Canada border near Winnipeg to Marshfield, Wis., $52 million, before FPC.

Continued on Page 52

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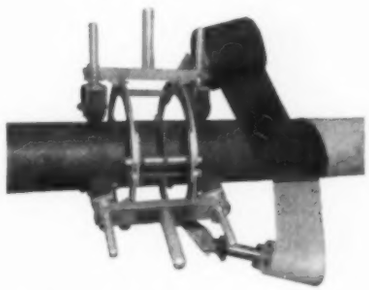
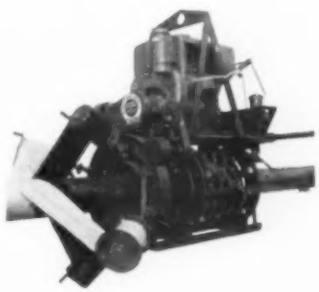


The MYOCO Tapemaster can use four arms to give any combination of tape and kraft or felt. Six various size machines available for ½" through 36" pipe; small machines use tape from ½" width through 9", large machines use 9" through 18" tape.



MYOCO Model OW Power Driven Cleaning and Taping machine combines two operations for increased speed of operations with less equipment. Line travel machines are available to handle pipe sizes 3" to 6", 6" to 12", and 14" to 20". A Wisconsin Model Vg4D V-type 4-cylinder heavy-duty air cooled engine, combined with the design and engineering features of this machine, guarantees uninterrupted service.

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These and similar operations at pipeline pumping stations are discussed in a new Oakite Service Report, B6878. For a free copy of this helpful report, write to Oakite Products, Inc., 51A Rector Street, New York 6, N.Y.

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PROPOSED CONSTRUCTION

continued

New York State Natural Gas Co., Pittsburgh, 30 miles, 20-inch, gas, main, Silver Springs to East Elma, N. Y., $1.6 million, temporary FPC authorization.

43 miles, 20-inch, point west of Kittanning to Luthersburg, Penn, 14 miles, 26-inch, Little Marsh in Chatham Township to Boom station near Lawrenceville, Penn., and additional horsepower at Woodhull, Utica, N. Y., and Preston and Tonkin, Penn., contract let on 14 miles, 26-inch to Williams Bros. Co.

Northern Illinois Gas Company, 140 miles, 24-inch, gas, main line, East Dubuque to Des Plaines, Ill., planned.

Northern Natural Gas Company, Omaha, 46 miles, 30-inch, gas, loops, in Iowa, Nebraska, and Kansas; 18-miles, lateral extension, and 6,000 hp additions in Kansas, Nebraska, and Iowa, $8 million, FPC examiner approval.

57 miles, gas, loops, Nebraska, Iowa, and Kansas, 8,000 hp additions in Kansas and Nebraska, $7.7 million, FPC examiner approval.

171 miles, main line extensions, 66 miles, main loops, 139 miles, branch lines, 6,000 hp additions, to extend system from Minneapolis to Duluth-Superior area, $25.7 million, before FPC.

46 miles, main line extensions, 191 miles, loops, 1,767 miles, branch lines, and 45,400 additional hp, in Iowa, Minnesota, South Dakota, Nebraska, Wisconsin and Illinois, $76.7 million, before FPC.

Northern Utilities Co., 35 miles, 16 inch, gas, in Fremont Natrona County, Wyo., area; 8 miles, 12 inch, around Casper; 6 miles, 8 inch, from Sand Draw gas field to Beaver Creek field; 12 miles, 6 inch, from Beaver Creek field to the system servicing the Riverton-Lander area, planned.

Ohio Fuel Gas Co., 51 miles, gas, main lines, in Belmont, Carroll, Cuyahoga, Fairfield, Logan, Lorain, Marion, Muskingun, Stark and Wayne counties, Ohio, $2.2 million, authorized.

Natural gas storage field in Medina County, Ohio, 12 miles, 4½ to 20-inch gas, $5 million, authorized.

Pacific Gas & Electric Co., San Francisco, 296 miles, 36-inch, gas, from Klamath Falls, Ore., to Antioch, Calif., southern section of line from Canada to California, before California Public Utilities Commission.

Pacific Gas Transmission Co., San Francisco, 614 miles, 36-inch, Kingsgate B.C. to Klamath, Ore., northern section of Canada to California line, before FPC.

Pacific Lighting Gas Supply Co., 128-mile, 34-inch, gas, main line from Topock, Ariz. to Newberry, Calif., authorized.

Pacific Northwest Pipeline Corp., Salt Lake City, 235 miles gas, gathering lines in San Juan Basin, Garmesa, Piceance Creek, and Big Piney Fields, $13.5 million, planned.

65 miles, gas, sales laterals in Washington, $1.5 million, planned.

Continued on Page 54

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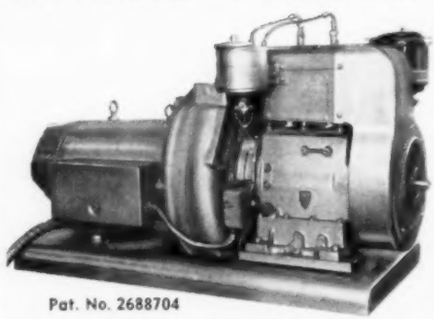

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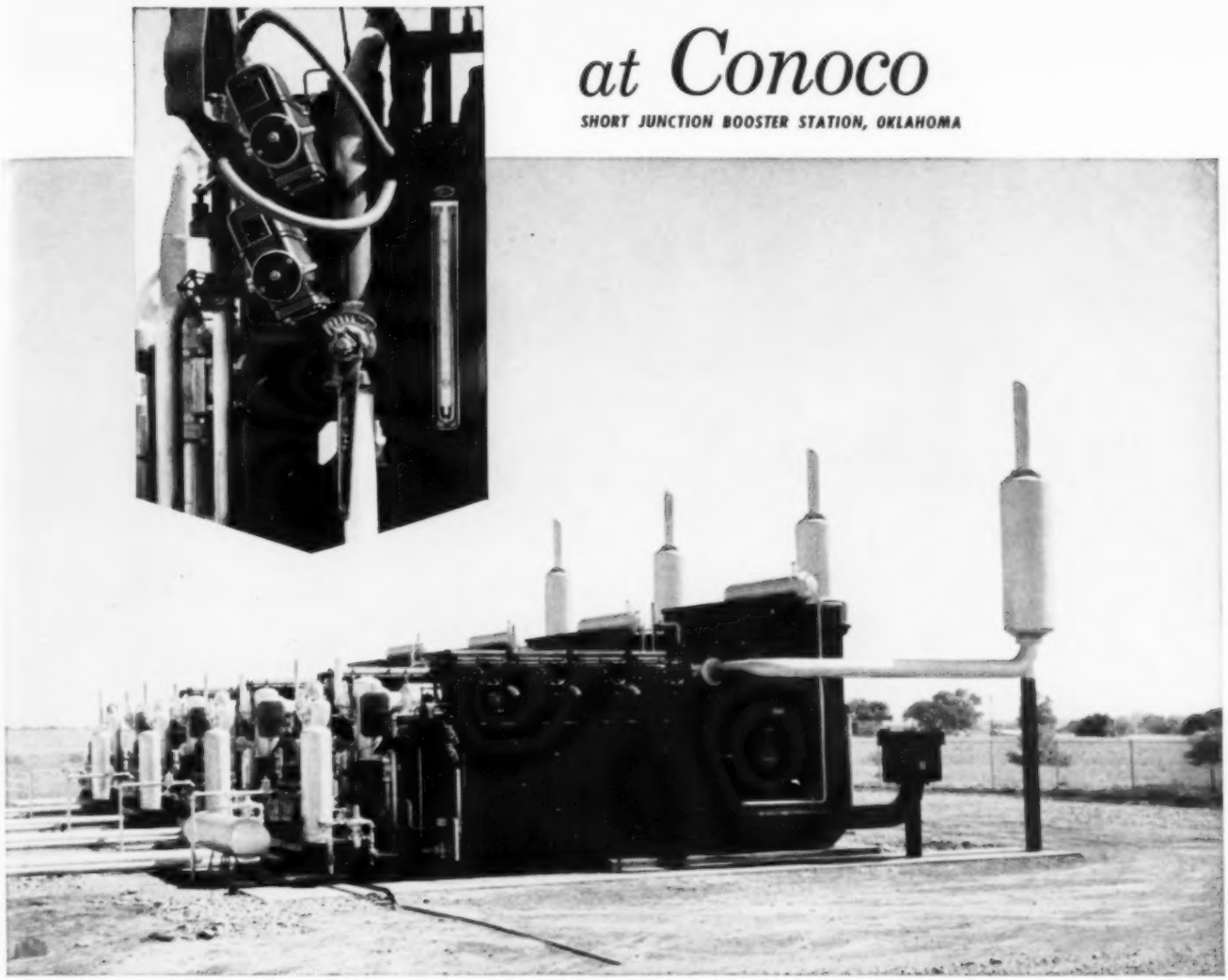

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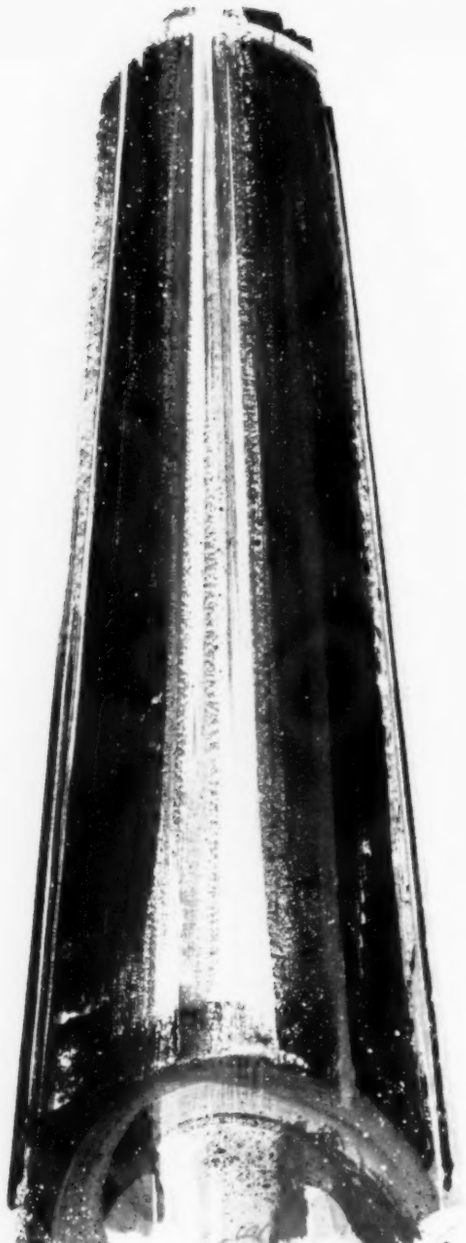

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PROPOSED CONSTRUCTION

continued

Pennsylvania Gas Co., Warren, Penn., 38 miles, 8 and 10 inch, gas, in Erie and Warren Counties, Penn., and Chautauqua County, N. Y., $2.6 million, authorized.

Peoples Natural Gas Company, 22 miles, 24-inch, gas, from Waynesburg, Penn. to West Virginia border, contract let to H. L. Gentry Construction Co.

Permian Basin Pipeline Company, Omaha, 83 miles, 16-inch, gas, from Pioneer's proposed facilities to Spraberry, Texas, and 3,960 hp compressor station, $5 million, before FPC.

Piedmont Gas Co., Hickory, N C., 78 miles, 2-8 inch, gas, from connection with Transcontinental Gas Pipe Line to serve customers in North Carolina, $2.6 million, authorized.

Pioneer Gathering System, Inc., Amarillo, Texas, pipe line facilities in Texas costing $3.7 million, before FPC.

Pioneer Natural Gas Co., Amarillo, Texas, 62 miles, 10-inch main, Pampa, Texas, to Canyon, in Randall County, Texas, 20 miles, small diameter, gathering, 4,000 h.p. stations, $4.5 million, planned.

Phillips Petroleum Co., 25 miles, 6 to 20-inch, gas, South Eunice, New Mexico area, planned.

52 miles, 4 to 20-inch, gas, Gaines County, Texas, planned.

44-mile, 6-inch, products line, from Rocky pump stations to Amarillo, Texas, planned.

Plantation Pipe Line Co., 90 miles, 4-10-inch, in Georgia, to be reconditioned, contract let to Latex Construction Co.

Richfield Oil Corporation, 60 miles, 20-inch, Cuyama to Ventura, Calif., contract let to Alex Robertson Co.

Rio Gas Gathering Co., San Antonio, 97 miles, 3 to 8-inch, gas gathering, South Texas, to supply gas to El Paso Natural Gas Company, planned.

Southern California and Southern Counties Gas Cos., Los Angeles, 200 miles, 34-inch, from Nevada-California border to point near Fullerton, Calif., $44 million, before Public Utilities Commission.

Southern Kansas Pipe Line Co., Inc., Arkansas City, Kansas, 200 miles, 6-10 inch, crude, southwestern Kansas to Arkansas City, Kansas, planned.

Southern Natural Gas Company, Birmingham, 458 miles, 16-24-inch, loop lines, gas, between Gwinville, Miss., and Wrens Ga; 62 miles, 14-inch, loops, along Atlanta-Macon line; 53 miles, 6⅝ to 14-inch, loops, along various branch lines. 3,140 additional hp at Gallion and Elmore, Ala. and Wrens, Ga. 60 miles, 20-inch, loops, in Louisiana between Franklington and White Castle and South of Toca. Lateral lines south of Gwinville and west to Cranfield field. 8,720 hp added at Franklinton, White Castle, Patterson and Brookhaven, $65 million. contracts let to River Construction Corp., H. C. Price, Latex Construction Co., and Houston Contracting Co. on 355 miles.

Continued on Page 58

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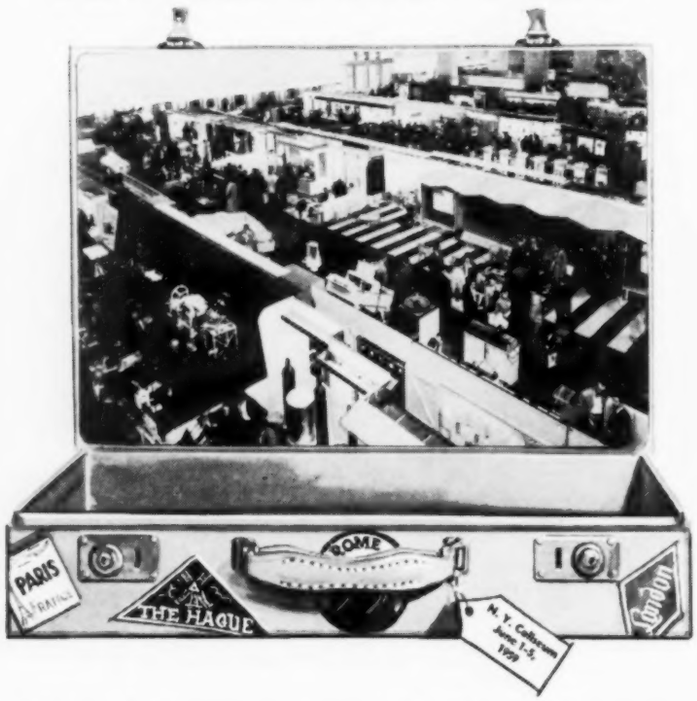

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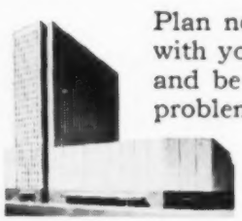

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PROPOSED CONSTRUCTION

continued

Tennessee Gas Transmission Co., Houston, 21 miles, 16-inch, 2 miles, 12¾-inch gas, Louisiana coast, Vermillion, Blocks 46 and 64, $2.9 million, before FPC.

158 miles, 36-inch, looping system in Louisiana and Mississippi, to supply Midwestern additional gas at Portland, Tenn. $61.4 million, before FPC.

Texas Eastern Transmission Corp., Shreveport, La., 267 miles, 14-30 inch, gas, Louisiana, Mississippi, Pennsylvania and New Jersey, $50 million, before FPC.

141,780 additional horsepower in existing stations, a new 2,200 hp compressor station, in Louisiana, Mississippi, Pennsylvania, Ohio, Kentucky and Tennessee, authorized.

65 miles, gas, Delmont, Penn., to Lambertville, N. J., before FPC.

Texas Electric Service Company, Fort Worth, 300 miles, gas, Old Ocean field to Fort Worth, Texas, $25 million, considered.

Texas Gas Gathering Corp., Shreveport, 36.6 miles, gas, gathering system in Rodney Field, Jefferson County, Miss. and from North and South Locust Ridge, Lake St. John Field in Tensas and Concordia parishes, La., $855,413, before FPC.

Texas Gas Transmission Corporation, Owensboro, Ky., 92 miles, 30-inch, 19 miles, 26-inch, and 15 miles, small diameter, loop portions of system in Louisiana, Arkansas, Mississippi, Kentucky, Indiana and Illinois; additional horsepower at Pineville, La., Kenton, Tenn., Calvert City, Ky., Slaughters, Ky., Dillsboro, Ind., and Petersburg, Ind., totaling 9,040 hp. $20 million, contract let to Houston Contracting Co. and Western Pipe Line, Inc.

246 miles, 26-30-inch, loops, between Eunice, La., and Lebanon, Ohio, 102 miles, supply lines, south Louisiana, and addition of 15,760 hp, $40 million, before FPC. Contract let on 75 miles to Houston Contracting Co.

Texas Illinois Gas Pipeline Company, Chicago, 16,000 additional hp to stations at Lufkin, and Marshall, Texas; Texarkana, Malvern, Searcy, and Biggers, Ark.; Jackson, Mo.; and Hammond, Ill., $3.9 million, before FPC.

Transcontinental Gas Pipe Line Corp., Houston.

149 miles, 36-inch, main loops, 34 miles, 20, 24-inch gathering, compressor stations at Nueces County, Texas and St. Helena Parish, La., additional hp in eight stations, $51 million, before FPC.

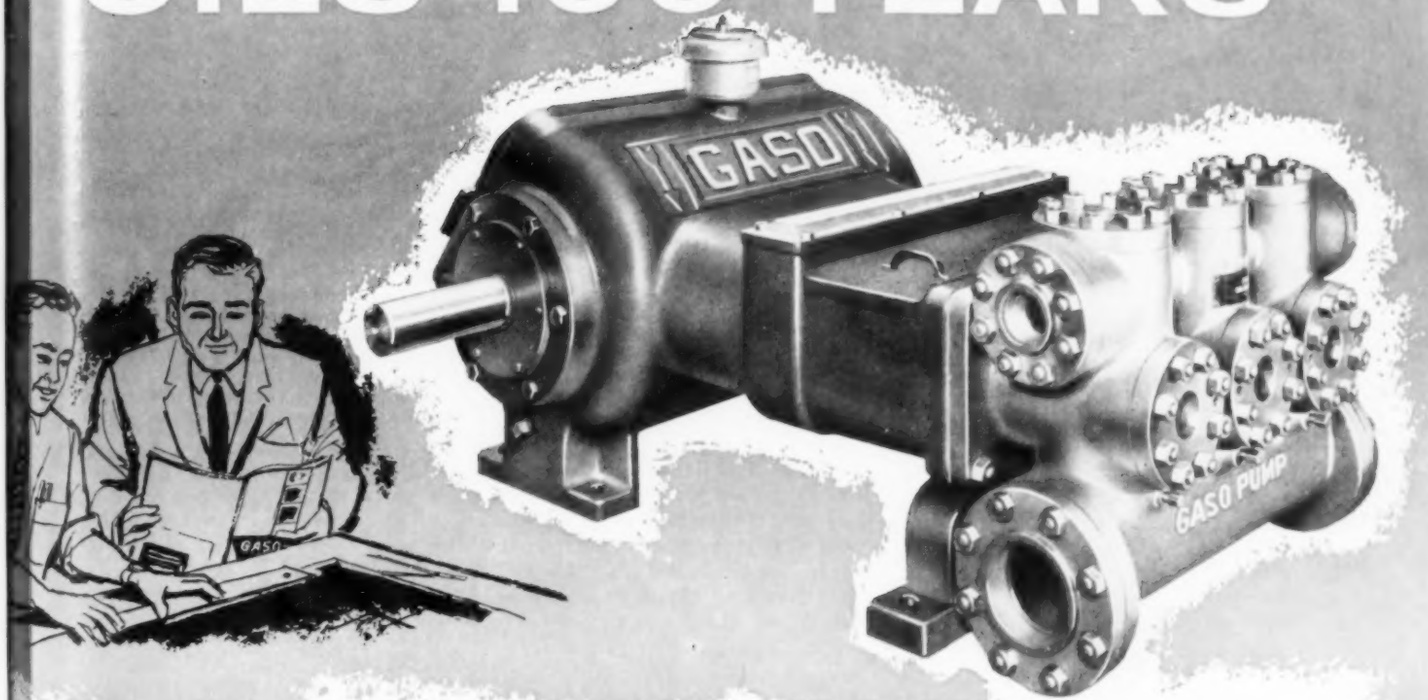
65 miles, laterals, southeast Louisiana, contract let to Ashy Construction Co.

4,200-foot, 24-inch, Hudson River crossing, contract let to Samuel Gallucci & Sons, Inc.

Transwestern Pipeline Company, Houston, 1,305 miles, 24- and 30-inch, gas, main line, from West Texas and Oklahoma-Texas Panhandle area to Topock, Ariz., $193 million, before FPC.

Continued on Page 60

FOR 44 OF OIL'S 100 YEARS



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PROPOSED CONSTRUCTION
continued

Trunkline Gas Company, Houston, 204 miles, 26-inch, gas, main line from Tuscola, Ill., to Michigan-Indiana border. 464 miles, 30-inch loops between Longville, La., and Tuscola and 45 miles, 24-inch, in Texas, 183 miles gathering, Louisiana, 3000 additional hp at Longville station, $81.5 million, appeal before FPC.

Underground Storage & Exploration, Upper Darby, Penn., 394 miles, 12-inch LPG, from Moundsville, W. Va. to Newark, N. J., $9 million, approved.
95 miles, 6-8 inch, laterals to Mauch Chunk, Penn., and to Philadelphia, planned.

United Gas Pipe Line Co., Shreveport, La., 203 miles, 30-inch, gas, between New Orleans and Mobile, Ala., $33.7 million, contracts let on 30-miles to O. R. Burden, 88 miles to Williams Bros., 12 miles to Western Pipe Line, Inc., 30 miles to Hallmac Construction Co., and 41 miles to Houston Contracting Co.

Valley Gas Transmission, Inc., Houston, 160 miles, 3 to 8-inch, gas, gathering, in Hidalgo, Brooks, Starr and Jim Wells Counties, Texas, $15 million, before FPC.

Wilcox Crude Oil Corp., Shreveport, La., 20 miles, crude line in east central Louisiana, $500,000, planned.

International

ACT Oils, Ltd., Montreal, 400 miles, crude, Dawson Creek, B. C., to Bella Coola, B. C., before B. C. government.

Alaska-Yukon Refiners and Distributors, Ltd., Edmonton, Alta., 150 miles, products, serving Alaska and Yukon territory, $3.5 million, planned.

Alberta Natural Gas Company (Jointly owned by Westcoast Transmission Co. and Alberta & Southern Gas Co. Ltd.) 36-inch, gas, Alberta border to British Columbia-Idaho border, supply gas to Pacific Gas & Electric Co., $40 million, planned.

Alberta Gas Trunk Line Co., Ltd., 122 miles, 30-inch, 79 miles, 16-inch, gas, main and laterals, Princess to Torrington, Torrington junction to Nevis and Carstairs area, $20 million, contracts let to Mannix Co. Ltd. and Marine Pipeline and Dredging Ltd.

Arab League Oil Committee, large diameter crude line from Persian Gulf to Mediterranean Coast, $500 million, considered.

Aurine Alps Railway & Pipeline, 200 miles, crude, Venice to Munich, Germany, considered.

Bituminous Oil Pipeline Co., Calgary, 250 miles, crude, from Athabasca tar sand plant in northeastern Alberta to Edmonton, approved.

Burmah Oil Co., Ltd., 850 miles, crude, 20 inch, from Nahorkatiya to Calcutta, India, planned.

Cartier Gas Corp. (St. Maurice Gas, Inc., and Consumers Gas Co., Toronto), 170 miles, gas, Montreal to Quebec City, planned.

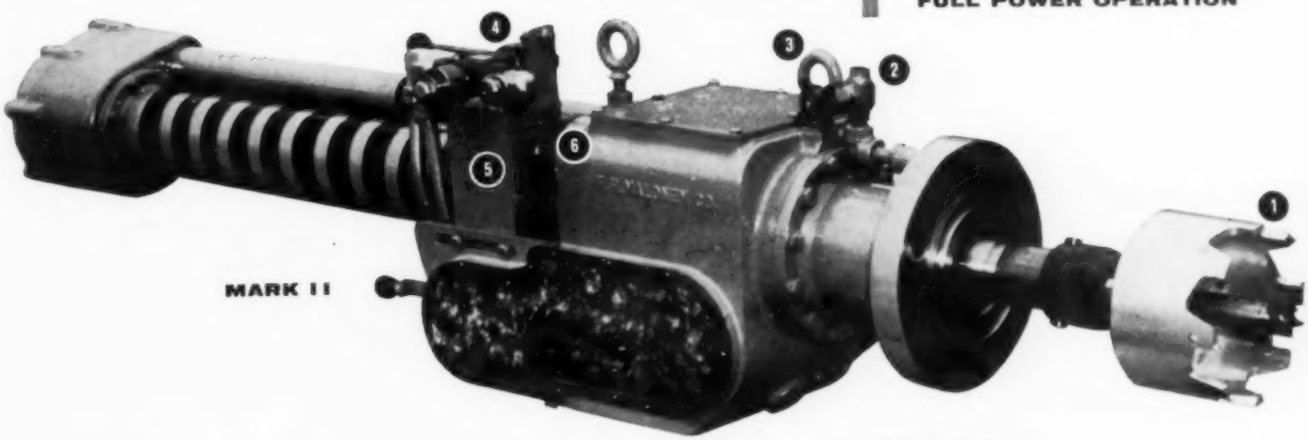
Continued on Page 63

Completely NEW High-Pressure Pipe Tapping Machines

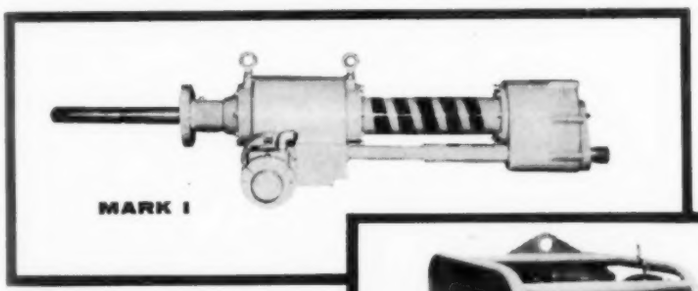
Maloney

MARK I
1 to 6 inch
air or hand crank

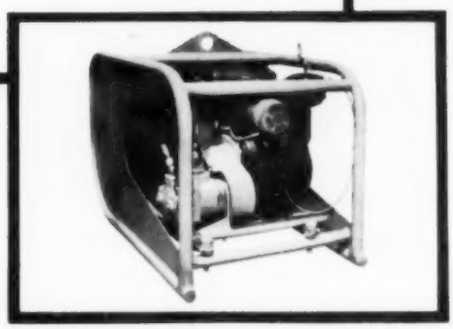
MARK II
4 to 16 inch
air or hydraulic
FULL POWER OPERATION



Over two years of intensive research and field testing have produced these all new high-pressure Tapping Machines. Conservatively rated at 1440 psi at 100° or 700 psi at 700°, the Maloney MARK I and MARK II incorporate every desired feature for rapid, safe, and accurate hot tapping, with complete power operation. Engineered and manufactured by the F. H. Maloney Company, completely within our own manufacturing facilities.



Based on the same design as the MARK II, the MARK I covers the range of high pressure taps from 1 inch to 6 inch. Available with air motor or hand crank operation, the MARK I is rated at the same operating pressures and temperatures as the MARK II. Twist drill cutters are available to 3 inch, shell type cutters to 6 inch. (MARK I Air Requirements 90 psi, @ 105 cfm.)



Companion Hydraulic Power Unit powered with 9 hp gasoline engine, completely self-contained. Provides ample power and positive control of cutter torque with calibrated, infinitely variable, flow control. Available as an accessory with the MARK II. (MARK II Air Requirements — 90 psi, @ 105 cfm.)

FEATURING

1. Revolutionary shell cutters provide cleaner cutting with less torque. Replaceable teeth, shell, and backplate for field maintenance.
2. Integral bleed-off valve.
3. Center of gravity well forward, near the cutting end of the machine, for easier handling. Vertical and horizontal operation with built-in lifting rings and bail.
4. Air or Hydraulic power (MARK II only), with ample reserve power. Completely reversible—makes the *full range* of cuts without alteration.
5. All operating controls grouped for simple operation.
6. Boring bar travel counter measures travel in .01 inch increments. No guessing where the cutter is.
7. Simplified design eliminates unnecessary maintenance. Designed to be operated and maintained by *your* operating personnel.

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MAY 14-22, 1959
Tulsa, Oklahoma

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"Something From the Irishman"

F. H. Maloney COMPANY

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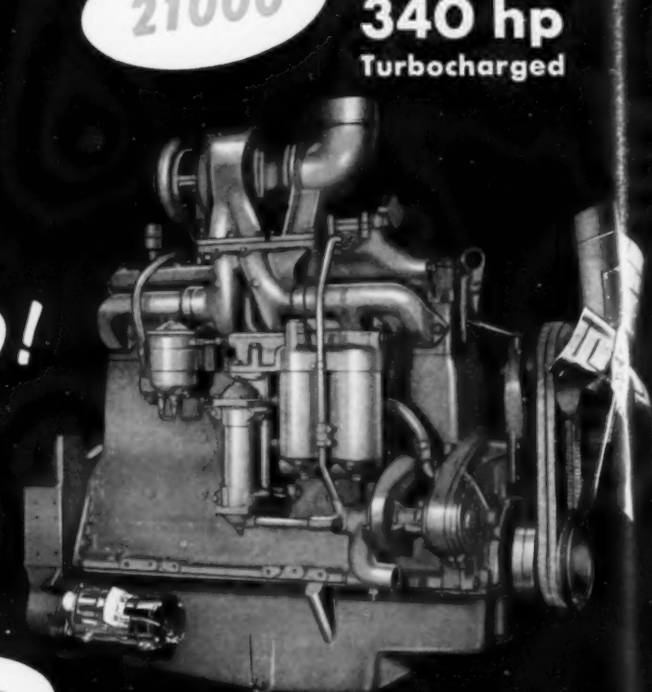
New Allis-Chalmers Diesels...

We Told You They Were Good, BUT THEY'RE BETTER THAN WE SAID!

21000 — **340 hp Turbocharged**



6 cylinders

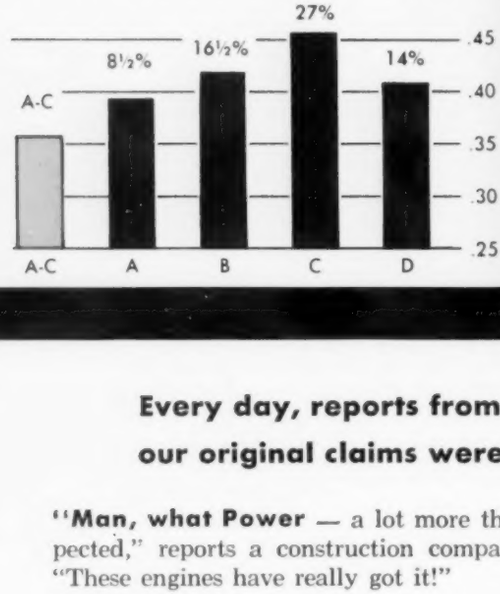
16000 — **230 hp**

Actual field performance now proves that the new Allis-Chalmers 21000 and 16000 are *even better* than we announced. This fuel consumption chart illustrates the big advantage they give you in economy and efficiency, but it doesn't say enough.

FUEL CONSUMPTION

Pounds per brake hp hr.

Percent of fuel savings with A-C over other diesels



Every day, reports from users prove that our original claims were understatements. Here are a few examples:

"Man, what Power — a lot more than we ever expected," reports a construction company spokesman. "These engines have really got it!"

"'Startingest' engine we've ever had," says a northern cement producer. "We threw away the ether can with temperatures way down below freezing — no external heating either."

"We can hardly believe the fuel economy, and it's doing heavy work, too," states a contractor. "Cleanest running engine we've ever seen."

"Wish we had this engine in all our equipment," says a midwestern user. "We're doing a good 25 percent more work with it — on the same amount of fuel. It's almost unbelievable!"

Greater economy, top usable power, superior starting, plus a cleaner, tougher, more serviceable design — these will put more profit in performance *on your job.*

Power <u>your</u> equipment with these new engines.

For full details, see your dealer or write for bulletin BU-540. Allis-Chalmers, Milwaukee 1, Wisconsin.

BE-14

ALLIS-CHALMERS

***POWER* FOR A GROWING WORLD**

PROPOSED CONSTRUCTION

continued

Colombian Petroleum Company, 68 miles, 12-inch, crude, Cicuco field to Covenas, planned.

Consolidated Gathering Systems, Ltd., Calgary, 198 miles, crude, Sturgeon field to Edmonton, planned.

Development and Resources Corp., 70 miles, 8 inch, gas, from Agha Jari oil field to Ahwaz, Iran, planned.

Entre Nazionali Idrocarburi, Rome, Italy, crude, from Qum field in Iran to the Mediterranean Sea, considered.

Foothills Pipe Line, Ltd., 500 miles, 12 to 16-inch, LPG, from Alberta to Pacific Coast, $80 million, considered.

Gibson Crude Oil Purchasing Co. Ltd., 170 miles, crude, Milligan Creek, B. C. to Grande Prairie, Alta., planned.

Hydrocarbons Pipeline, Ltd., Winnipeg, Manitoba, 880 miles, 6-8 inch, products, from Edmonton to Winnipeg, $35 million, partial authorization.

Independent Pipe Line Co., 2,019 miles, 34-36-inch, crude, Edmonton to Montreal, 23,000 pump horsepower, $395 million, before Borden Commission.

Interprovincial Pipe Line Company, 350-mile extension from Toronto to Montreal, looping line from Edmonton to Toronto, crude, $240 million, considered.

6,150 hp pump station at Iron River, Mich., and 4,450 hp addition at Edmonton, Alta., $2 million, planned.

Iraq Petroleum Company, 80 miles, 30-32-inch, crude, loop line, Rumaila field to Fao, Iraq, planned.

Island Transmission Company Limited, Nanaimo, B.C., 25 miles, 10-inch, gas, from point near Vancouver, B.C. to Vancouver Island, 67 miles, 10-inch, laterals to Victoria and Nanaimo, B.C., $14 million, planned.

Mid-Continent Pipe Lines, Ltd., 1500-mile, 30-inch crude, Edmonton to Chicago, planned.

NATO, 211 miles, crude, 6-inch, between Malatya-Cetinkaya-Erzincan, Turkey, $6 million, bids asked.

National Iranian Oil Co., 146 miles, 6 inch, crude, from Azna to Isfahan, Iran $5 million, planned.

1000 miles, 38 inch, crude, from central Iran to the Turkish Mediterranean coast, considered.

Peace River Oil Pipe Line Co., Ltd., 70-mile, crude, Swan Hills to Iosegun Junction, approved.

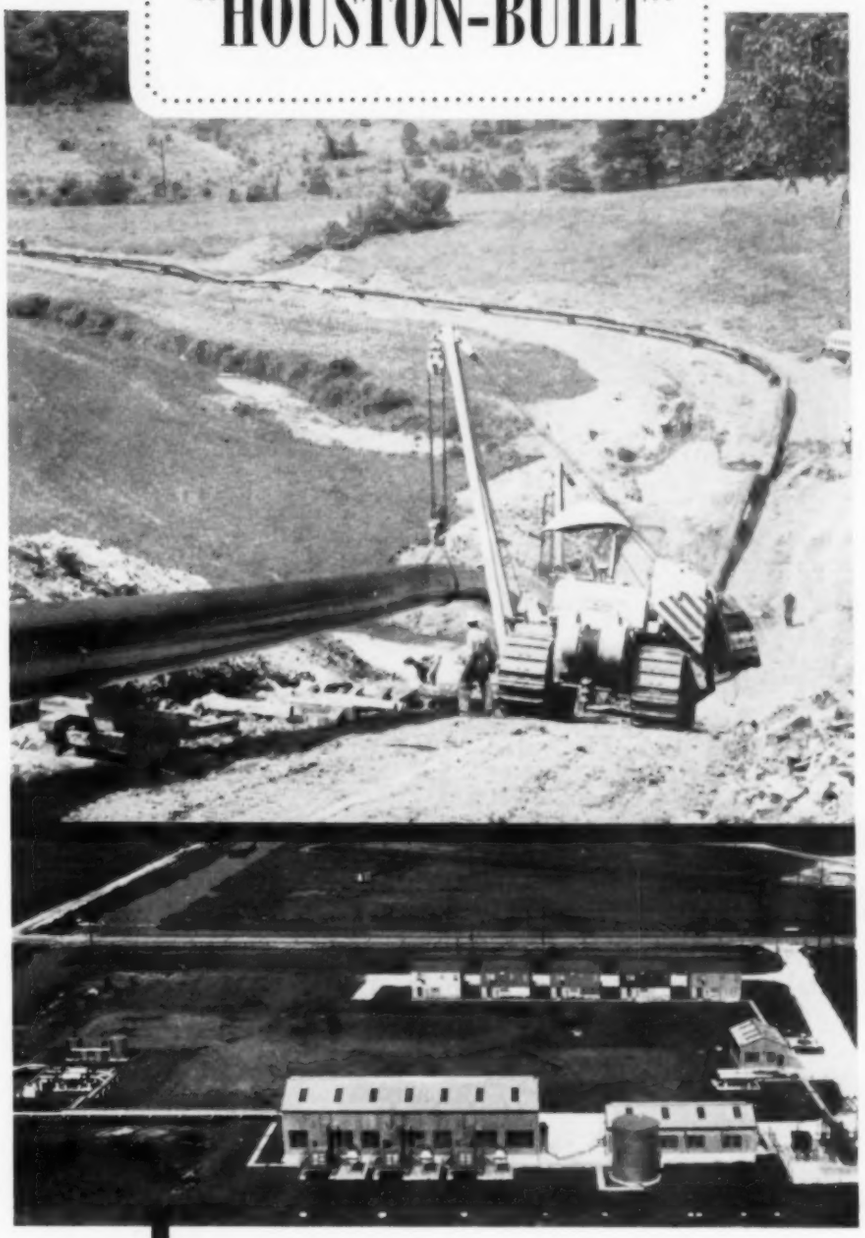
220 miles, 8-inch, crude gathering, from fields in northeast British Columbia to Dawson Creek, B. C., and Grande Prairie, Alta., and to existing lines at Sturgeon Lake, planned.

Pembina Pipe Line, Ltd., Edmonton, 1,200 miles, LPG, from Alberta gas fields to eastern Canada, planned.

Petroleos Mexicanos, 38 miles, 4 inch products, from Mexico City to Toluca, $500,000 planned.

Continued on Page 66

"HOUSTON-BUILT"



From the Gulf Coast to the Great Lakes, Louisiana compressor station or Ohio transmission line, Houston Contracting builds the best today playing a vital part in the growing underground-transportation industry. Uncompromising quality is the cornerstone of Houston's enviable reputation in the pipeline construction field.

HOUSTON CONTRACTING COMPANY

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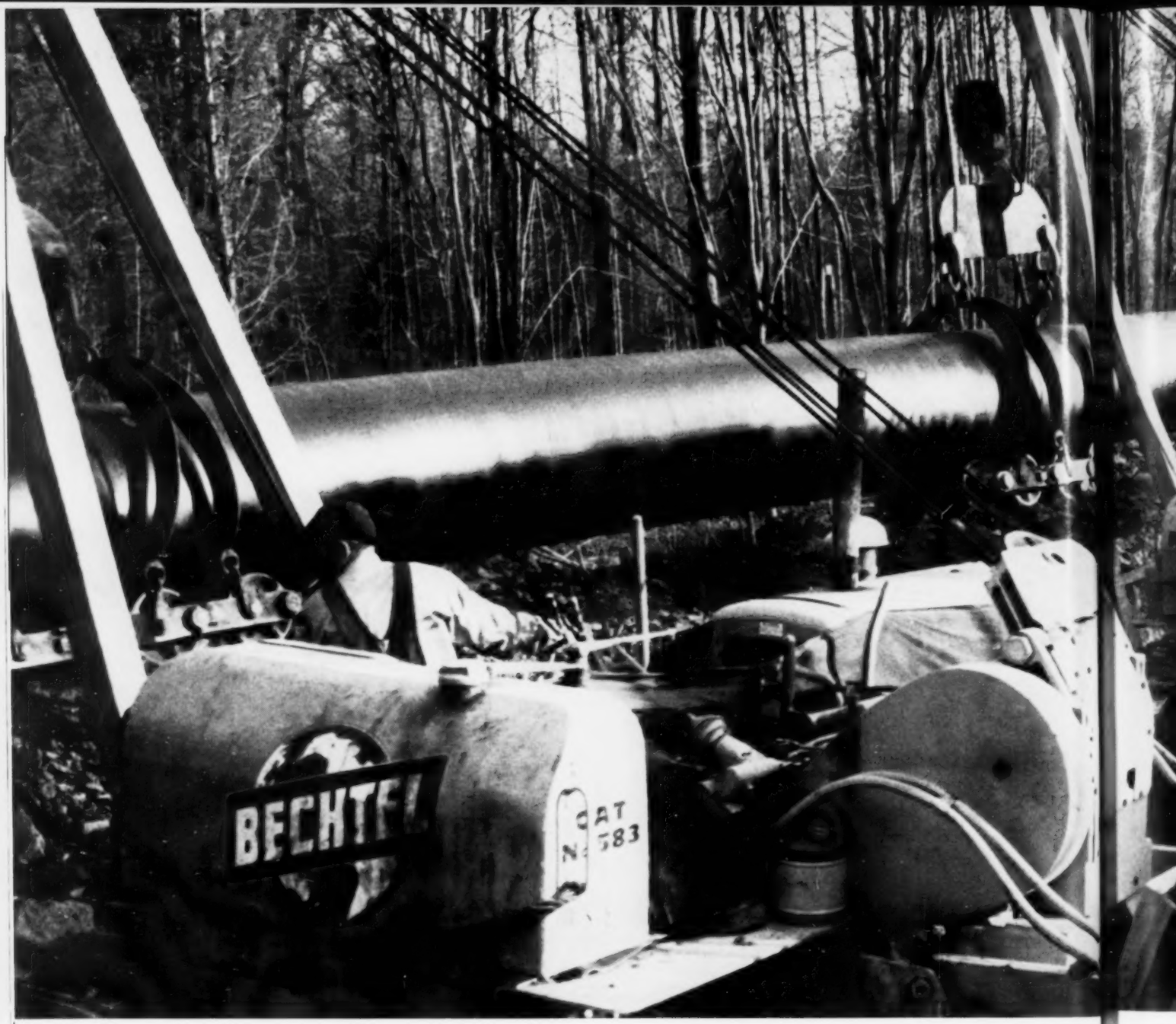
OIL • GAS • PRODUCTS • WATER PIPELINES

For more data on advertised products, use Readers' Service Cards, last page.



BETHLEHEM LINE PIPE

now produced to 42 in.

It's Bethlehem Steel Line Pipe for many reasons: for top quality in materials and manufacture; for top uniformity in size, surface, and wall; for top performance in every type of installation.

At our Steelton, Pa., plant we have new facilities for cold-expanding electric fusion-weld pipe *18 to 42 in. OD.* And on our new mill at Sparrows Point, Md., we produce electric resistance-weld pipe from $5\frac{9}{16}$ in. to 16 in. OD *in lengths to 60 ft.*

For top economy in every phase of pipe line construction and operation, use Bethlehem Steel Line Pipe. Let our nearest sales office quote on your requirements.

	SIZES (in., OD)	WALL THICKNESS (in.)	LENGTHS	SPECIFICATIONS
HYDRAULICALLY EXPANDED ELECTRIC FUSION-WELD (submerged arc)	18 through 24 26 through 36 36 through 42	¼ to ½ incl. ¼ to ⅝ incl. ¼ to ¾ incl.	40-ft	API 5LX, Grades X42, X46, X52 & X56
ELECTRIC RESISTANCE-WELD	5 (nom) to 16	API	to 60-ft	API 5L, Grades A & B API 5LX, Grades X42 & X46
CONTINUOUS BUTT-WELD	½ to 4 (nom)	API	SRL 24 to 26-ft DRL to 50-ft	API 5L
COMPRESSOR STATION PIPE in diameters, thicknesses, and lengths as required.				

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On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

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SAFETY is a matter of fact

Safety during pipe line laying—for men and equipment—becomes a matter of fact when you specify Wickwire Slings. Made from top quality Wickwire Rope, they assure you of long-term service and dependability for pipe line laying and other construction projects.

ECON-O-GRIP ATTACHMENT. The Econ-O-Grip eye attachment is the most economical *safe* sling you can buy. A special aluminum alloy sleeve, pressed on under tremendous pressure, holds the strand ends of the rope together so tightly that the splice becomes virtually one piece.

Wickwire Slings are available in four fabric constructions, with a wide variety of fittings for use with Wickwire single- and multiple-legged slings.

For complete information on Wickwire Slings, attachments and fittings, contact the nearest CF&I sales office.

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In the West: **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque • Amarillo • Billings • Boise • Butte Denver • El Paso • Farmington (N.M.) • Fort Worth • Houston • Kansas City • Lincoln • Los Angeles • Oakland • Odessa (Tex.) • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle Spokane • Tulsa • Wichita

In the East: **WICKWIRE SPENCER STEEL DIVISION**—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) New Orleans • New York • Philadelphia

PROPOSED CONSTRUCTION

continued

126 miles, 4, 6 and 8 inch, product, from Mexico City to Cuernavaca and Puebla, $2.5 million, planned.

214 miles, products, Monterrey to Torreon, $6.5 million, planned.

Pipelines of Puerto Rico, Inc., 95 miles, 8-inch, products, Penuelas to San Juan, Puerto Rico, planned.

Royal Dutch Shell, 160 miles, 20-inch, crude, Tandjung to Balikpapan, Indonesia, $60 million, contract let to Williams Brothers Co. and John Brown Ltd.

Saskatchewan Power Corp., 52 miles, 6-inch and 24 miles, 4-inch, gas, from St. Louis to Tisdale, 79 miles, 10-inch, gas, Success to Rosetown, and 113 miles, 8-inch, gas, from Regina to Yorktown, contracts let to Marine Pipeline and Dredging Ltd. and Dutton-Williams Brothers Ltd.

Sociedad Nacional de Oleoductor, 75 miles, crude, from Santiago-to-Valparaiso, $3 million, planned.

Societa Nazionale Metanodotti, 250 miles, 18-inch, crude and products, Genoa to Milan-Cremona-Torino, Italy, and Geneva, Switzerland, considered.

Sui Gas Transmission Co., Multan, Punjab, India, 145 miles, 8-inch, gas, from Sylhet to Dacca, East Pakistan, $9 million, considered.

130 miles, 16-inch, gas, main line, Multan to Lyallpur, planned.

Trans-Canada Pipe Lines Limited, Toronto, compressor stations at Ignace, Geraldton and Hearst, Northern Ontario, and Maple, north of Toronto, $15.5 million, planned.

Trans-Europe Pipe Line, 700 miles, 30 inch, main trunk, crude, from Mediterranean to northern Europe, considered.

Trans-Prairie Pipelines, Ltd., Edmonton, crude line, from Weyburn field to Regina-Moose Jaw areas, $5 million, considered.

Union Gas Company of Canada Limited, 45 miles, 8-inch, gas, main, Stratford to Goderich, Ontario; 10-miles, 8-inch, main, to Amhertburg; 10-miles, 12-inch, lateral, Galt to Brantford, planned.

Venezuela Sun Oil Co., 18-inch crude line in Lake Maracaibo, planned.

Westcoast Transmission Company, Ltd., 174 miles, 30-inch, gas, Savanna Creek gas field, Alberta, to British Columbian border, $45 million, planned.

Williams-McWilliams Industries, Inc., New York, 441 miles, 6-inch, crude, Villa Montes, Bolivia to Villa Hayes, Paraguay, considered.

Yacimientos Petroliferos Fiscales, Buenos Aires, Argentina, 621 miles, 12-inch, products, Mendoza to San Lorenzo, Argentina, $19 million, planned.

281 miles, 12¾ inch, crude, Pichana to San Miguel Tucuman to Techint, S. A., planned.

450 miles, 16-inch, crude, from Neuquen Province to Bahia Blanca, planned.

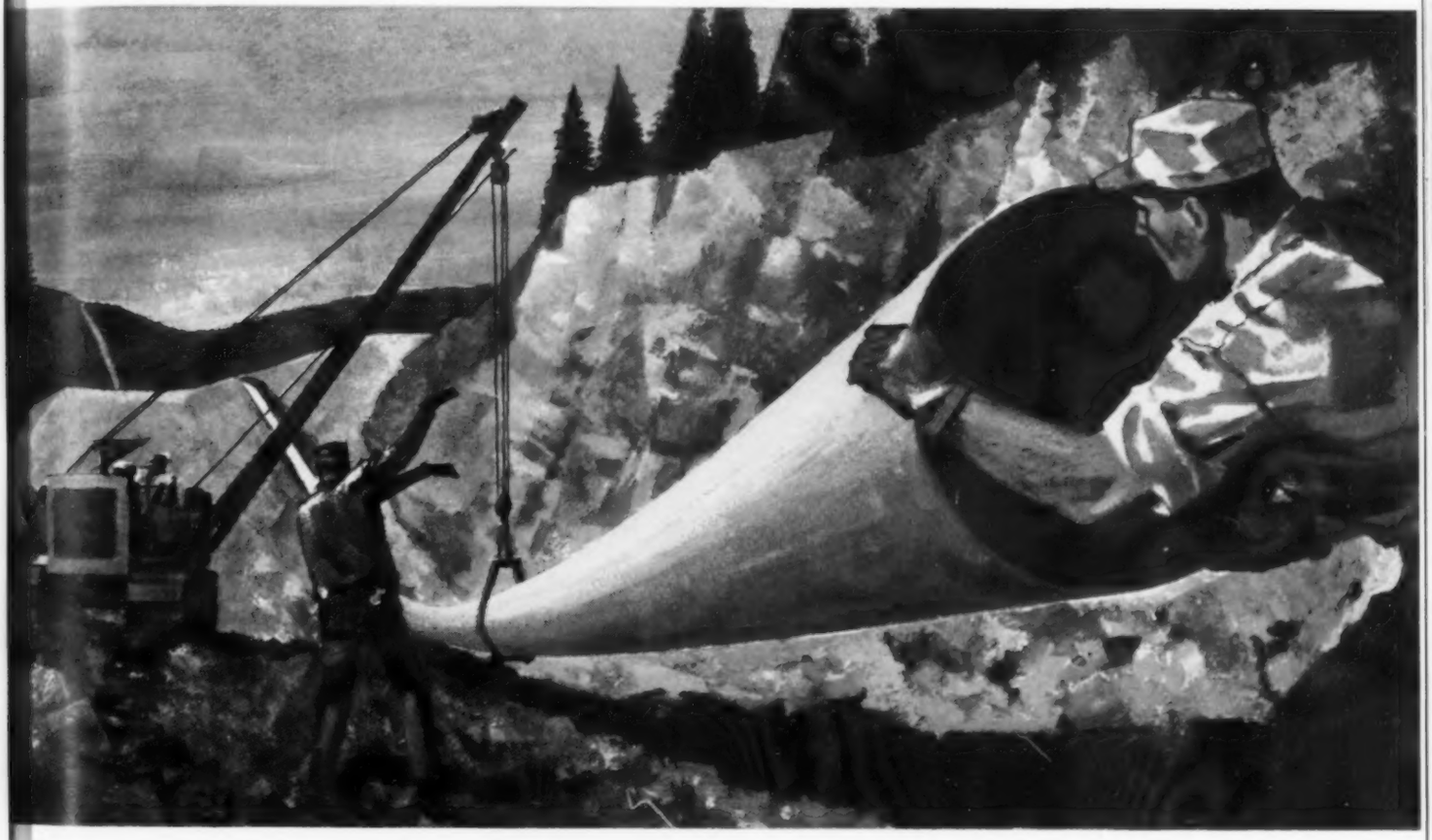
272 miles, gas, Bahia Blanca to Mar del Plata, under construction.

Putting the Laurel to bed

That's The Laurel Pipe Line! Recently completed, this 440-mile line is the first to use 24-inch-diameter pipe in a major cross-country refined products system.

Gasoline and other petroleum products will be transported through the line from Delaware River Valley refining centers to inland marketing areas such as Reading, Harrisburg, Pittsburgh and Cleveland.

National Tube supplied the pipe for the Laurel Line—approximately 66,000 tons of USS National Seamless and Electric Weld Line Pipe in sizes 24″ O.D. to 14″ O.D. for the main line and 9,000 tons for feeder lines, take-offs, and terminal facilities.



The eastern section of the main line, some 135 miles, is 24″ diameter, API 5L X-52 pipe, ranging from .281 to .375-inch wall thickness. Initially, the line's throughput is expected to be about 100,000 barrels a day; however, this can be increased to 300,000 barrels with additional pumping stations. This line will make a greater variety of refined products available, in increased quantities, at a considerably lower transportation cost.

The Laurel Pipe Line represents another first for USS National Line Pipe. Why is USS National consistently chosen for rugged line pipe assignments? The answer in a word: *Performance.* You see, National Line Pipe combines the qualities of strength and dependability to give you a better product. Remember, too, that National Line Pipe is available in a complete range of wall thicknesses, steel analyses and in diameters up to 26 inches in Seamless and up to 36 inches in Electric Weld. For more information, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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National Tube Division of USS **United States Steel**

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CARRYING TEXAS AND LOUISIANA MARKETS WHERE THE NATURAL GAS TO THE MOST PEOPLE ARE

TRANSCONTINENTAL GAS PIPE LINE CORPORATION

Northern Natural Receives FPC Examiner's Approval

Northern Natural Gas Company won approval by an FPC examiner to construct facilities at a cost of $15 million.

One application includes 46 miles, 30-inch paralleling sections of its existing system in Iowa, Nebraska and Kansas and an 18-mile lateral extension to supply 50 MMcf daily to Northern Illinois Gas Company.

The second application includes 57 miles, main line loops, paralleling section of system in Iowa, Nebraska and Kansas and 8,000 hp in stations in Kansas and Nebraska.

1,497 Exhibitors to Display Equipment at IPE in Tulsa

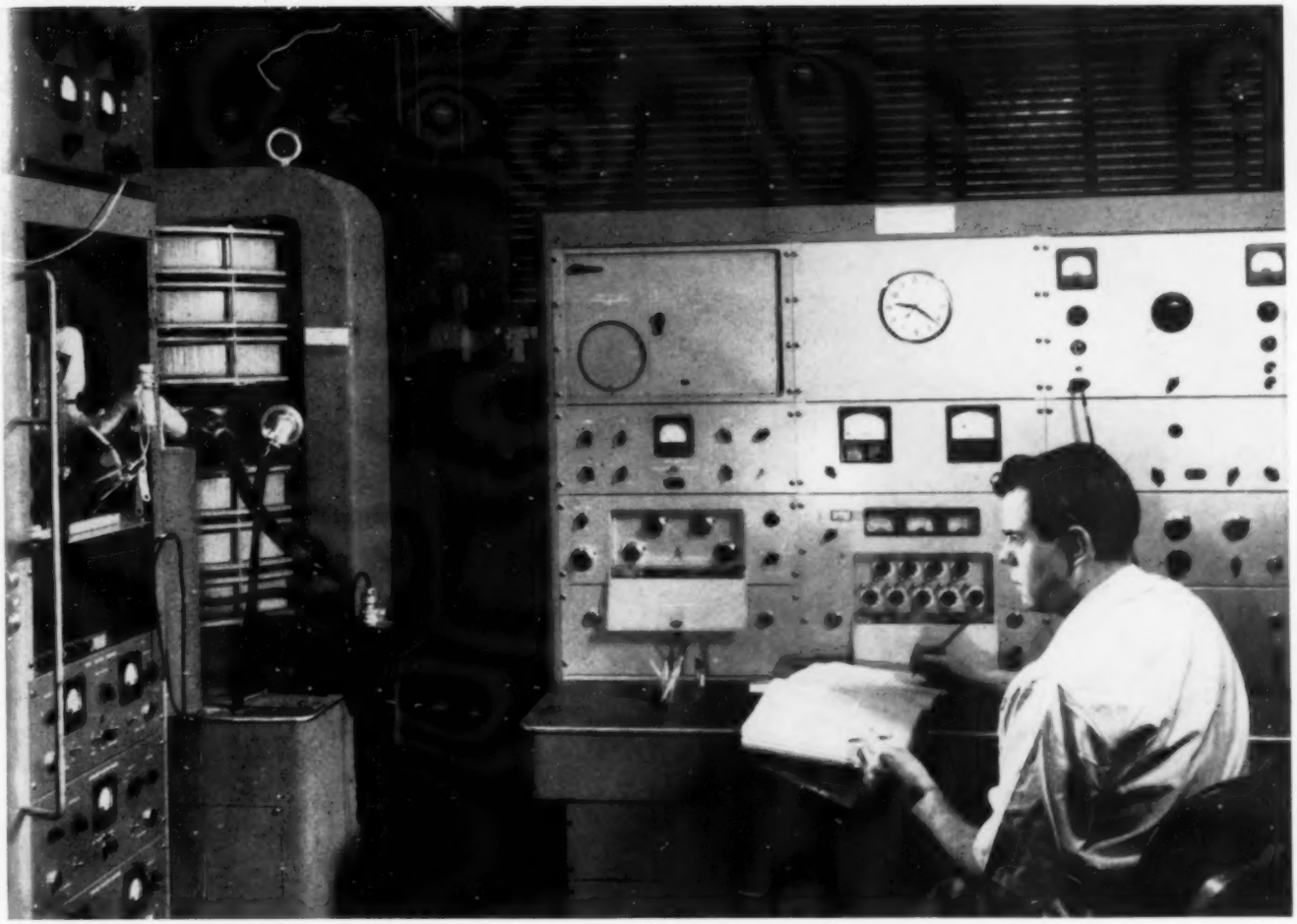
A complete sellout of exhibit space for the International Petroleum Exposition May 14-23 was announced early in April.

A total of 1,497 exhibitors will display a half-billion dollars worth of equipment; 1,000 building booths and some 26 acres of outside space has been taken for this show. Expected to attend the IPE are some 30,000 oil and gas men and 6,000 exhibitor personnel in addition to about a half-million of the general public.

Some exhibits for the pipe line industry will feature working models of an automatic pipe line system, remotely controlled from a central dispatching board; the operation of an electric motor-centrifugal compressor station; a modern turbine-driven centrifugal compressor; a tanker designed to carry liquefied petroleum gases; and a working model of a caisson for use in repairing underwater lines.

ABILITY

SACHSE ELECTRIC INC.
BATON ROUGE LA.



Tracing oil performance to its source—molecular composition, through mass spectrometer analysis at Gulf Oil's Research Center in Harmarville, Pa.

Gulf scientists score major advance in controlling lube oil performance

What makes a good lube oil perform well? Not too long ago this was a baffling mystery locked in the unknown arrangement of lube oil molecules. A good oil worked—but no one really knew why.

To find the answer, Gulf scientists literally tore the invisible molecules apart through electron bombardment in a mass spectrometer. The fragments were then analyzed, and the molecular make-up related to such factors as viscosity, pour point and oxidation resistance.

This makes it possible to tailor lubricants for specific jobs by controlling the structure of their molecules. Tougher lubricants can be made to withstand the tremendous pressures, heats and extreme tolerances of the future in aircraft, rocketry, atomic energy and other industrial processes.

Gulf Oil scientists, while not alone in researching lube oil composition, have developed a new technique in applying the mass spectrometer to this purpose, and in "making sense" from the resulting data.

GULF OIL CORPORATION
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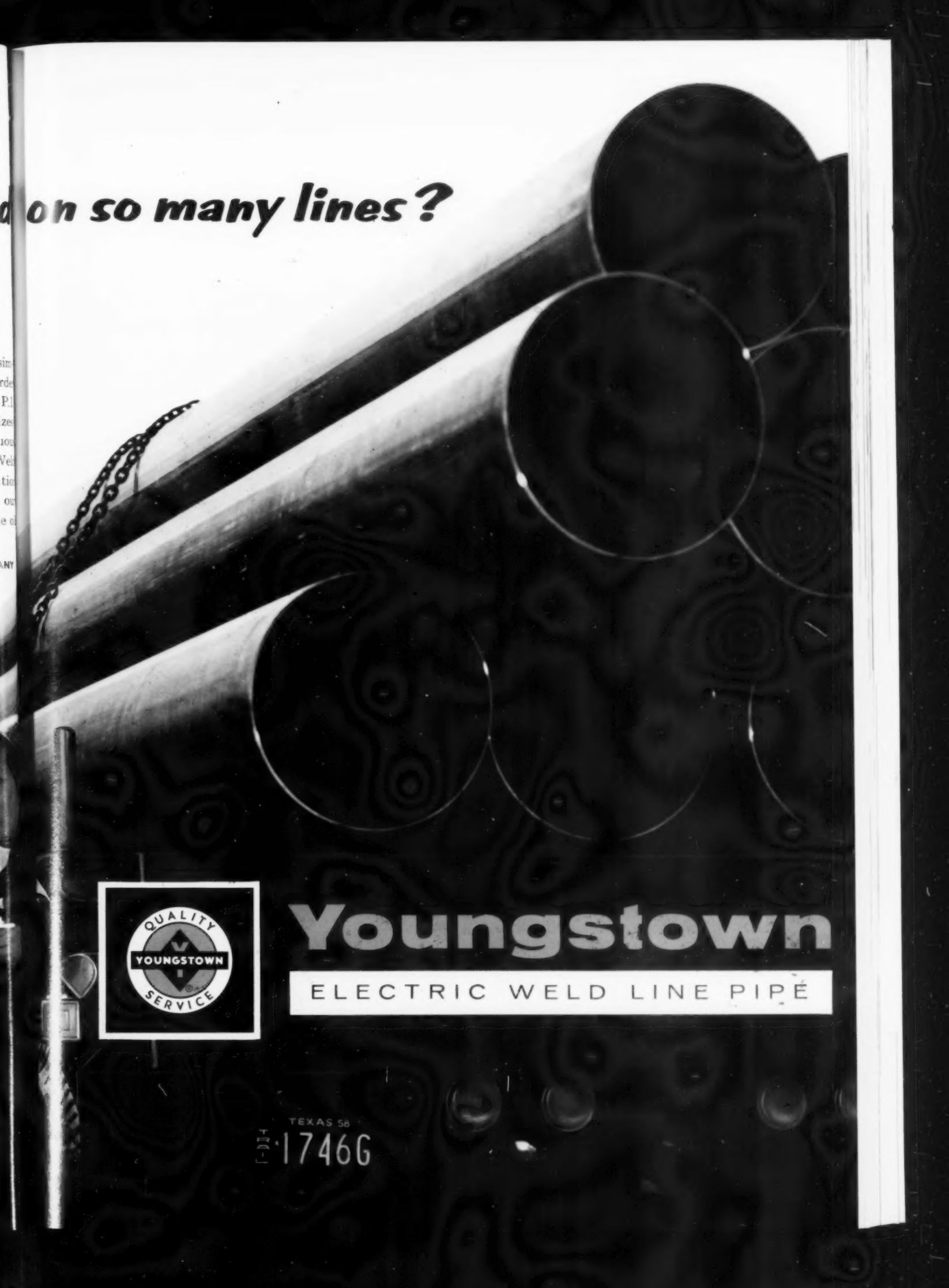
For more data on advertised products, use Readers' Service Cards, last page.

Why is this Youngstown pipe used o

All Youngstown Line Pipe is given a thorough final visual inspection before shipment. Trained inspectors carefully examine the pipe for possible imperfections which might interfere with its field performance. Every length is inspected for dimensional accuracy. That's one more reason why Youngstown pipe can be found on so many lines.

Because Youngstown Line Pipe helps sim plify and speed up the job. You can (rde Youngstown Line Pipe in high test A P weights and grades . . . and in these s zes Seamless—2⅜″ to 14″ O.D., Contin ou Weld—⅛″ to 4½″ O.D., and Electric Wel —6⅝″ to 22″ O.D. For more informatio about Youngstown Line Pipe contact ou sales and service offices throughout the o and gas-producing country.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Youngstown 1, Ohio


on so many lines?
QUALITY
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ELECTRIC WELD LINE PIPE
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FIELD ANALYSIS

A chain's as strong as its weakest link. In pipelines . . . its welded joints. Today, more than ever, inspection that guarantees performance is a job for radiography.

Superay "A" is a film tailored to meet the demands of pipeliners. Its high speed slashes minutes from exposures, saving hours from total inspection time, and it can find flaws of less than one percent of total weld thickness. Superay "A" can bring dramatic savings in field inspection and maintenance costs, and provides a positive guarantee of weld quality.

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Ansco

Industrial X-Ray

What's Happening

among MEN in the INDUSTRY

Pemex President Speaks in Dallas

Pascual Gutierrez Roldan, left, newly appointed president of Petroleos Mexicanos, talks with John B. O'Connor, right, president of Dresser Industries, Inc., at Dallas airport. Roldan spoke before a group of 500 oil men at a luncheon given in his honor in Dallas.

S. M. Williams

F. H. Lerch

Eight pioneer oilmen will be given special awards during the International Petroleum Exposition, May 14-23, it was recently announced by **William J. Sherry**, chairman of the IPE 'Old Timers' committee.

W. L. Connelly

William L. Connelly, Tulsa, one of the founders of **Sinclair Oil & Refining Corp.** was named "Pioneer of Pioneers." Seven others, each representing a division of the industry will be awarded on May 17th. The "Grand Old Men of the Oil Industry" include **Edmond C. Breene**, Oil City, Penn.; **William A. Cassidy**, Bayonne, N. J.; **Edward I. Hanlon**, Tulsa; **S. Miller Williams**, Robinson, Ill.; **Frank J. Hinderliter**, Tulsa; **Wiley B. Hisson**, Tulsa; and **Frank L. Lerch**, New York.

Connelly, still active at 86 as consultant with Sinclair and vice president of Delaware Consolidated Oil Corp., has been in the industry 68 years. He has served as president of a number of Sinclair companies and served as chairman of board for Sinclair Oil & Gas Company from 1932 to 1950, when he retired.

Breene, 81, who represents the production division, is chairman of the board of **Winona Oil Co.** which he helped found in 1906.

Drilling representative, Hissom, 66, was owner and president of **Hissom Drilling Co.**, and now serves as an advisor to the company.

One of the organizers of the IPE in 1923, Hinderliter, 84, is the grand old man of supplies and equipment. He founded the **Hinderliter Tool Co.**

Hanlon, 78, natural gasoline division, is president of the **Hanlon Oil Company** and chairman of National Bank of Tulsa and Hanlon-Boyle, Inc.

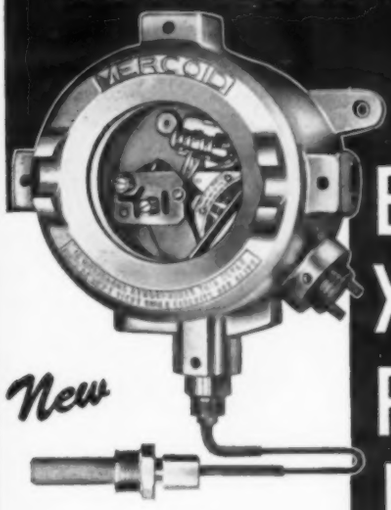
Williams, 72, one of the founders of **Williams Brothers Co.**, is the grand old man of pipe line and transportation. Williams retired after the company completed the Trans-Arabian crude line in 1950 and is an honorary member of the Pipe Line Contractors Association.

Lerch, 71, natural gas representative, was chairman of the board of **Consolidated Natural Gas Co.** before retiring in 1953. He had been president of Interstate Natural Gas Co., Inc., Mississippi River Fuel Corp., and Colorado Interstate Gas Co.

Cassidy, 93, is grand old man of refining, retired in 1926 as superintendent of the **Standard Oil Trust** refinery in Bayonne.

MERCOID® TEMPERATURE CONTROLS

EXPLOSION-PROOF



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SERIES DAH-35
REMOTE STEM
TEMPERATURE CONTROLS

APPROX. WEIGHT 9¼ LBS.

OUTSIDE ADJUSTMENTS

VISIBLE CALIBRATED DIAL

VISIBLE OPERATION
You can tell at a glance whether switch circuit is on or off

SEALED MERCURY CONTACT

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SURFACE OR PANEL MOUNTING

OPERATING RANGES
13 operating ranges from -60+30°F. to 370-530°F.

Available with Breather or Drain

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*LISTED BY

Series DAH-35
Class 1, Group C & D;
Class 2, Group E, F, G;
NEMA 7CD, 9EFG

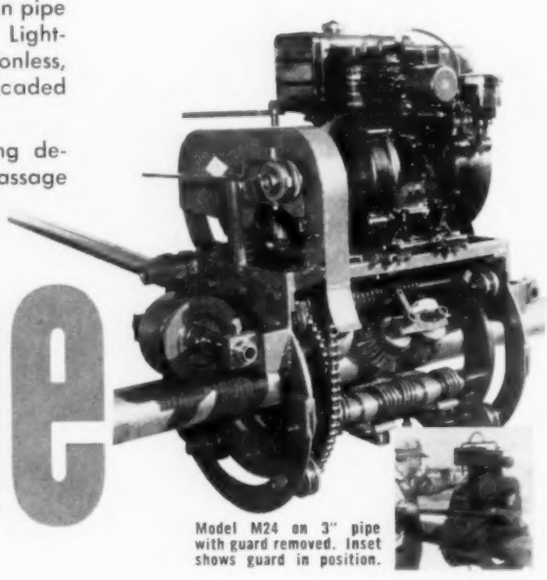
For more data on advertised products, use Readers' Service Cards, last page.

cleans pipe faster

NEW REMCO SELF PROPELLED PIPE CLEANING MACHINE MOUNTS IN 15 MINUTES!

Perfect for new pipe or reconditioning work, this new, compact cleaning machine will clean pipe up to 10 times faster. Lightweight and nearly vibrationless, it is ideal for working on loaded lines.

With an exclusive floating design which permits easy passage over collars, it uses standard knives, cutters and brushes or the new Remco rotary cup brushes. Easily adapted for taping, priming, doping, or for stationary service, it comes in 6 standard sizes for 2" through 30" pipe.



Model M24 on 3" pipe with guard removed. Inset shows guard in position.

OTHER REMCO PIPELINE EQUIPMENT INCLUDES:

HOLIDAY DETECTORS—CLEANING AND PRIMING MACHINES—TAPE WRAPPING MACHINES—DOPE KETTLES — PIPE FINDERS SUPPLIES

REMCO

MANUFACTURERS AND DISTRIBUTORS OF PIPELINE EQUIPMENT AND SUPPLIES

REMCO MFG. CO.

BOX 3005 • TULSA, OKLAHOMA

PHONE: TEmple 5-1504

SEE US IN TULSA AT THE IPE NE COR. SPACE 205

Felix A. Mulgrew, vice president of the Bankers Trust Company's Public Utility Group, has been named a director of the **Houston Corporation.**

Felix A. Mulgrew

Mulgrew joined Bankers Trust Company in 1955 as a special representative in public utility work and became a vice president in 1956. Prior to joining the company he was associated with Burns and Roe, Inc., Public utility engineers.

James C. Elmore, senior assistant engineer, has been named division engineer and transferred from Shreveport, La., to Baytown, Texas, by **Texas Eastern Transmission Corporation.**

Elmore has been with the company for 10 years, joining as a junior engineer in Shreveport. In 1955 he was named assistant engineer.

Samuel C. Phelps, former chief engineer, has been named to the position of manager—operating services, for **Interstate Oil Pipe Line Company's** general office in Shreveport.

He will have responsibility for engineering department, material-traffic department and the supervisor of tariffs. Phelps joined the company in 1943 as a senior engineer in Tulsa; in 1953 he was made assistant chief engineer and became chief engineer in 1954.

Election of **William A. Strauss** as executive vice president of **Northern Natural Gas Company** was announced by **John Merriam**, president.

William A. Strauss

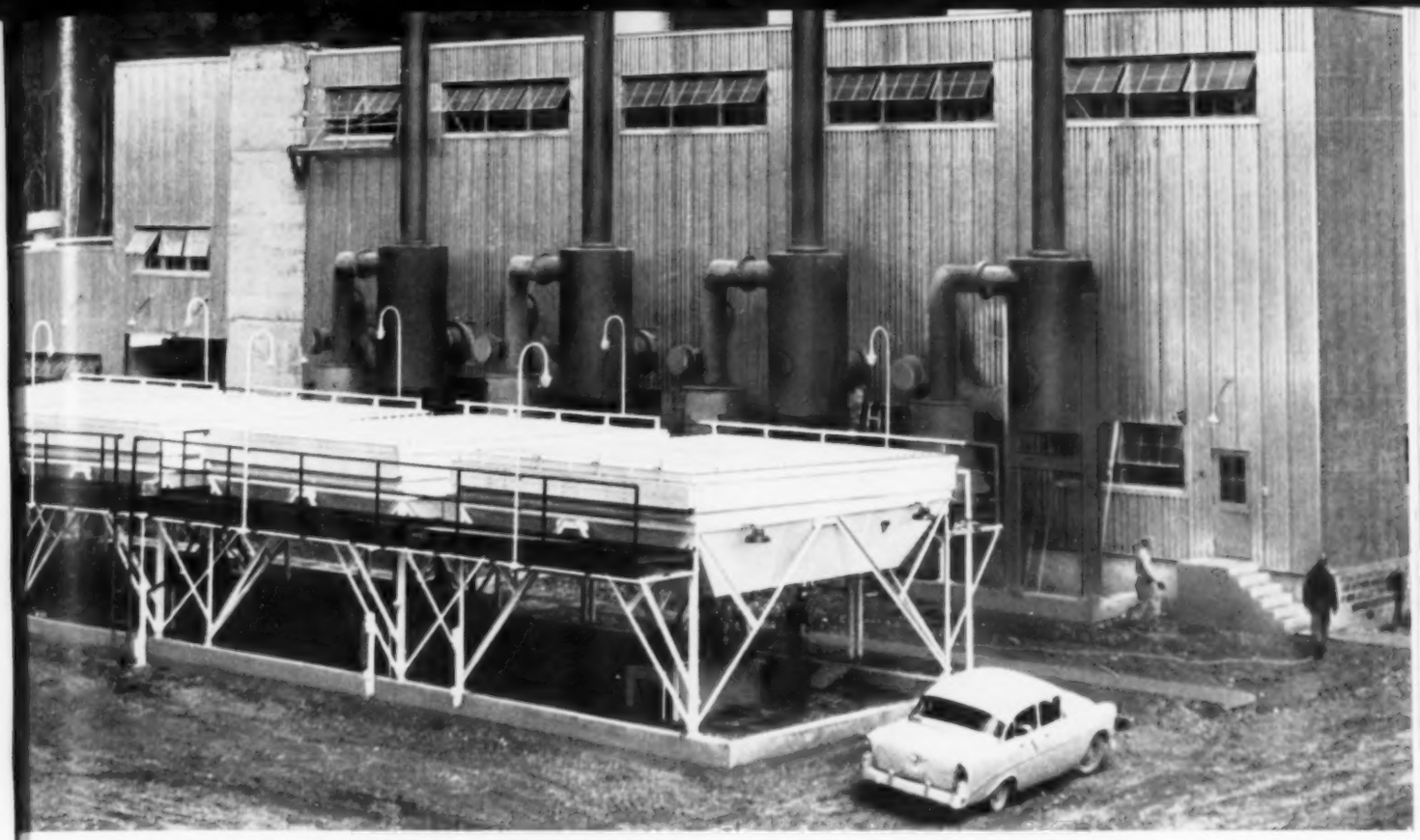
Strauss will report to the president and under his direction will be responsible for all the operations of the company, working within the framework of the policies established by the president, the policy committee and board of directors.

Strauss formerly was administrative vice president.

DEATHS

Henry Tuttle, 62, president of Michigan Consolidated Gas Company, died March 26 at Henry Ford Hospital in Detroit. He had been ill for five months.

Tuttle was elected vice president and controller of Michigan Consolidated in 1940 and was named to the board of directors in 1944. In 1945, he became vice president and treasurer and was made executive vice president in 1949. He was elected president in 1952. He was named a director of American Natural Gas Company, of which Michigan Consolidated is a subsidiary, in 1951. Tuttle was a vice president, treasurer and a director from 1947-1951 of Michigan Wisconsin Pipe Line Company.



Twenty air cooled units like this cool engine jacket water for four Canadian "Big Inch" compressor stations. Units are designed to dissipate 8.6 MBTU/hr. from the 288 gpm jacket cooling water at temperatures from 170 to 110° with an ambient temperature of 90° F. General contractor: Canadian Bechtel, Ltd.

Canadian "Big Inch" cools jacket water with Trane Fluid Coolers - at 35° below !

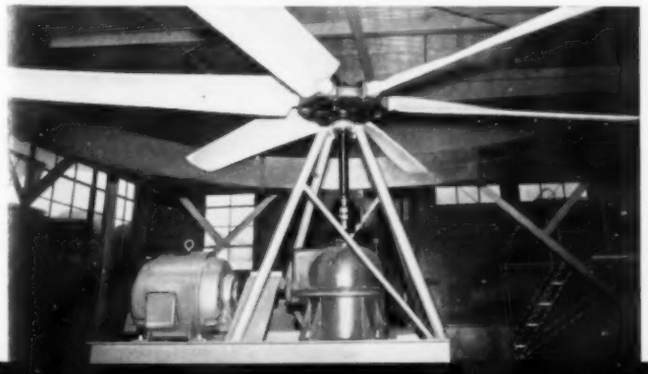
Westcoast Transmission Company's 650 mile-long, 30-inch pipeline system through British Columbia passes through country where winter temperatures are very low. Cooling engine jacket water for compressor stations along the way takes rugged equipment—coolers that can function efficiently at 35 or 40 degrees below zero.

Westcoast Transmission Company chose TRANE Fluid Coolers for this important job. Air cooling was essential at these extreme temperatures. And TRANE Fluid Coolers have shown that they meet exacting requirements under all weather conditions.

More and more major transmission companies are turning to TRANE for rugged, dependable Fluid Coolers. Many of these companies report simplified maintenance, a minimum of adjustment problems. And, with TRANE Fluid Coolers, engineers know that they can depend upon the accuracy and completeness of the capacity ratings—based upon the industry's most complete laboratory testing.

When you have a fluid cooling problem, turn to TRANE! Call your nearby TRANE Sales Office. Or write TRANE, La Crosse, Wisconsin.

The air handling segments have shutters for control of their forced vertical air flow, with variable-pitch propellers. (TRANE Fluid Coolers are also available with horizontal discharge.) 2-speed fan, motor and drive are factory-aligned on a single metal base. All framework parts are predrilled and match-marked.



For <u>any</u> air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 100 U.S. AND 19 CANADIAN OFFICES

Lincoln **WELDYNAMICS**

NEWS ABOUT ARC WELDING AT WORK CUTTING COSTS

AMAZON JUNGLE ABUSE CAN'T STALL LINCOLN WELDER!

The Lincoln K-6090, SA-200 gas engine-driven welder is the long-time favorite of pipeliners all over the world for trouble-free operation. The reputation that the K-6090 is building for itself isn't limited to the pipe line industry, however.

Wherever dependable performance, under torturous conditions is a necessity, the K-6090 is earning praise.

The following unsolicited letter attests to the fact:

"Enclosed please find photographs of a Lincoln welder, SA-200, which we have been using on our mining operation in the Amazon River district of Brazil during the past year.

"This Lincoln welder was the most dependable piece of equipment that we had and dependability is the most important asset for a piece of machinery working in the jungle where there are no spare parts and the operators are semi-skilled. Since oxygen and acetylene are unavailable in northern Brazil, the welder was heavily overloaded continually when we used it for burning and cutting steel without any effect on its performance. It operated perfectly on the poor-quality gasoline that we had to use.

"Manpower, pushing and pulling, were the only ways of moving equipment. Even with this rough handling and the adverse tropical climate, torrential rains, heat and humidity, the welder never failed to start and operate perfectly.

"The 110 DC power output receptacle was extremely useful when we were repairing equipment at night and would not only be welding but lighting our riverside camps.

". . . I can only add that the SA-200 is a fine piece of equipment."

THE LINCOLN ELECTRIC COMPANY

Dept. 5107 • Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

WHO'S MEETING WHERE

May

LPGA, 28th annual meeting, Conrad Hilton Hotel, Chicago, May 3-6.

API, safety and fire protection committees 12th midyear meeting, Rice Hotel, Houston, May 4-8.

API Division of Transportation, annual pipe line conference, Penn-Sheraton Hotel, Pittsburgh, May 13-15.

International Petroleum Exposition, exhibit of oil industry equipment, Tulsa, May 14-23.

AGA, operating section transmission conference, Statler-Hilton Hotel, Dallas, May 18-19.

Pennsylvania Gas Association, Pocono Manor Inn, Pocono Manor, Penn., May 19-21.

Florida-Georgia Gas Association, spring convention, Fort Harrison Hotel, Clearwater, Fla., May 20-23.

Natural Gas & Petroleum Association of Canada, Hamilton, Ont., May 20-21.

ASME, design engineering conference, Convention Hall, Philadelphia, May 25-28.

14th Annual Short Course in Gas Technology, Texas College of Arts and Industries, Kingsville, Texas, May 27-29.

Fifth World Petroleum Congress, The Coliseum, New York City, May 31-June 6.

June

NACE, Teche Section, corrosion control short course, Southwestern Louisiana Institute, Lafayette, La., June 2-4.

NACE, Appalachian Underground corrosion short course, West Virginia University, Morgantown, W. Va., June 2-4.

Kentucky Oil & Gas Association, annual meeting, Phoenix Hotel, Lexington, June 4-5.

ISA, second international symposium on gas chromatography, East Lansing, Mich., June 10-12.

ASME, semi-annual meeting, Chase-Park Plaza Hotel, St. Louis, June 14-18.

Society of Automotive Engineers, summer meeting, Chalfonte-Haddon Hotel, Atlantic City, June 14-19.

ASME, applied mechanics conference, Virginia Polytechnic Institute, Blacksburg, Va., June 18-20.

American Society for Testing Engineers, annual meeting, Chalfonte-Haddon Hall, Atlantic City, June 21-26.

Michigan Gas Association, meeting, Grand Hotel, Mackinac Island, June 22-23.

Canadian Gas Association, annual meeting, Empress Hotel, Victoria, B. C., June 22-24.

SAFETY IN THE RIGHT PERSPECTIVE

with Flexitallic Spiral-Wound Gaskets

In this enlarged sectional view, you can see the Spiral-Wound Gasket construction originated by Flexitallic in 1912. And you can see Flexitallic Blue, the blue dye in the Canadian asbestos filler, which is the mark of an engineered Flexitallic Gasket.

Flexitallic means sealing at its safest. You get performance you can depend on throughout all pressure/temperature ratings, because the compression characteristics of the gasket are always related to the pressure/temperature ratings of the flanges with which they are assembled.

When fluids are confined in a critical pressure/temperature range . . . when flanged joints are subject to thermal and mechanical shock, vibration, weaving, and other joint stresses . . . engineers demand the maximum in gasket performance.

That's why they specify Flexitallic Spiral-Wound Gaskets.

FLEXITALLIC GASKET CO.
8th & Bailey Sts. Camden 2, N.J.

Flexitallic®
SPIRAL-WOUND GASKETS

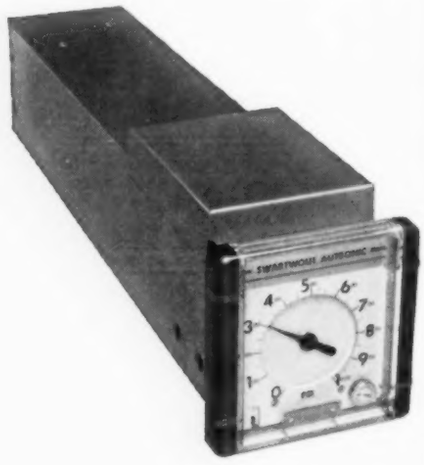
FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Flexitallic is a registered tradename. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue* — it's our exclusive blue-dyed Canadian asbestos filler.

Great things are happening in AutroniC® Control

NEW

DIGITIZER



translates analog signal to digital code for telemetering, direct data reduction

With electronic null-balance accuracy, Swartwout's new Indicating-Digitizer directly converts transmitted data on any process variable into a digital code suitable for computation, telemetering, data logging or preparation of punched cards and tape. It indicates the variable, too, and may be operated in parallel with recorders and controllers.

Operating on the standard 0-0.5V AC AutroniC signal, the Digitizer employs a differential-transformer feedback circuit for high-accuracy indication and encoding. Optional, built-in alarm switches provide for wide-range high/low alarm signals.

The entire instrument is packaged in a panel-mounting case that fits into a standard five-inch-square cutout. Calibration adjustments are readily accessible; the entire unit is of plug-in type construction for easy servicing.

Totally new, but thoroughly tried and tested, the Swartwout Digitizer is another advance in the new industrial era pioneered by Swartwout with fully electronic AutroniC Process Control.

For details on the Indicator-Digitizer, request Specification Sheet A-806. The Swartwout Co., 18511 Euclid Avenue, Cleveland 12, Ohio.

SWARTWOUT

. . . world leader in electronic process instrumentation

S-A. 1869

ON THE LINE

Two Booths Better Than One

A booth within a booth may prove to be the coming thing for industrial exhibits demonstrating technical products at large conventions. Employing such a scheme, Armstrong Cork Company's Industrial Division will install a phone booth, with a direct line to its research center, at its exhibit booth for the Design Engineering Show in Philadelphia May 25-28.

Visitors to the booth seeking detailed technical information about specific products will be invited to pick up the phone (free of charge) and speak directly with Armstrong's research man responsible for that product in Lancaster, Penn.

Advantages of such a system—eliminates necessity of having a large staff of engineers and scientists present at the exhibit booth.

Gas Technology Short Course

One of the feature presentations of the Texas A & I 14th annual gas technology short course at Kingsville, May 27-29, will be a joint session on "Liquefication, Storage and Transportation of Methane." On the program will be W. M. Deaton, U.S. Bureau of Mines, moderator; James W. Hunt, Constock International Methane, Ltd., and James DeLury, J. F. Pritchard and Company.

The SGA sponsored short course will include sessions on natural gas transmission, production and conditioning. Key subjects include compressor selection, fuel cell, underground storage, mass flow measurement, and pipe line efficiency.

W. C. Magee, Jr., president of Tennessee Gas Pipeline Company, will preside at the opening session; L. T. Potter, president of Lone Star Gas Company, will give the principal address and the response will come from O. W. Clark, SGA president. Applications for enrollment, which will be limited to 200, should be sent to Dr. Frank Dotterweich, Texas A & I, Kingsville, Texas.

IPE Guide Book

An oil man's guide book to the International Petroleum Exposition has been published by Gulf Publishing Company. The 50-page booklet will be a directory of the exposition and include an alphabetical listing of all exhibiting companies and a special classified product index.

Copies will be distributed at the PIPE LINE INDUSTRY booths at the IPE in Tulsa, May 14-23.

TGT to Award Scholarships

Tennessee Gas Transmission Company has established a program for college scholarships for children of deceased employes, it was announced by Gardiner Symonds, chairman of the board.

The first scholarships will be awarded for the 1959-60 academic year. A selection committee will judge the applicants. The awards will be based on aptitude and scholastic record, character and potential ability, seriousness of purpose and financial need. Applicants are free to choose any field of study and scholarships can be used to any accredited college or university.

Texas Eastern Reduces Tariffs

Texas Eastern Corporation's Little Big Inch division has reduced tariff rates for petroleum products.

The new rates into Chicago from Beaumont, Texas, will be 40 cents per barrel on gasolines and 44 cents per barrel on distillates as compared with the present rate of 48 cents for either product.

Quoted from Mr. Dillard Stokes' Column, Shreveport Journal, Oct. 13, 1958.
"President Washington, who spoke of usurpation, said in his Farewell Address: 'If in the opinion of the people, the distribution of the Constitutional powers be in any particular wrong, let it be corrected by an amendment . . . but let there be no change by usurpation; for . . . this is the customary weapon by which free governments are destroyed' "

Specify **PELCO** Welding Saddles

PELICAN SUPPLY CO. INC.

P. O. Drawer 1108 Shreveport (84), La.
SEE YOUR NEAREST SUPPLY HOUSE

Tested by time... Proved by performance

NICOLET PIPE LINE FELTS

Nicolet Pipe Line Felts have passed through the toughest of all tests — the proving-grounds of actual use. They have stood up under the most adverse of soil and stress conditions — over many hundreds of miles of pipe line installations.

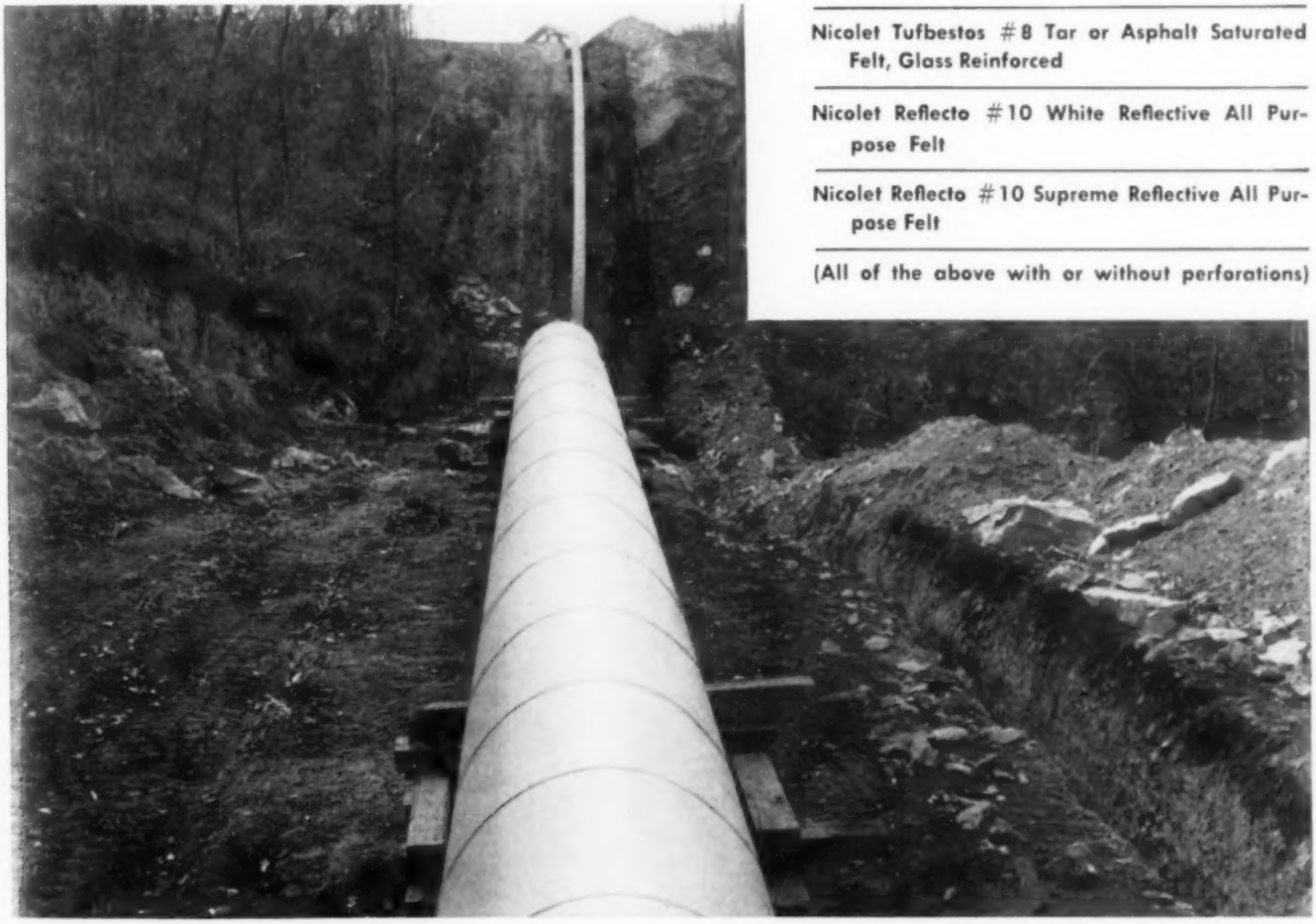
Because Nicolet makes the widest and finest range of Pipe Line Felts obtainable — 10 in all — you may be sure there is at least one perfect for the conditions you encounter.

When you specify Nicolet you are asking for the maximum in Pipe Line protection — and getting the safest, surest protection, hence the most economical, you can buy.

Pick the exact Nicolet Pipe Line Felts you need to meet your job specifications:

- Nicolet Standard #15 Tar or Asphalt Saturated Felt, Plain
- Nicolet Standard #15 Tar or Asphalt Saturated Felt, Glass Reinforced
- Nicolet Tufbestos #8 Tar or Asphalt Saturated Felt, Plain
- Nicolet Tufbestos #8 Tar or Asphalt Saturated Felt, Glass Reinforced
- Nicolet Reflecto #10 White Reflective All Purpose Felt
- Nicolet Reflecto #10 Supreme Reflective All Purpose Felt

(All of the above with or without perforations)



• **WRITE, WIRE OR PHONE TODAY FOR FULL INFORMATION about any or all the high quality Nicolet Pipe Line Felts.**

NICOLET INDUSTRIES, Inc.
FLORHAM PARK, NEW JERSEY
Norristown, Pa. • Hamilton, Ohio
DISTRIBUTED THROUGHOUT UNITED STATES.

For more data on advertised products, use Readers' Service Cards, last page.

For More Dependable Equipment and Service

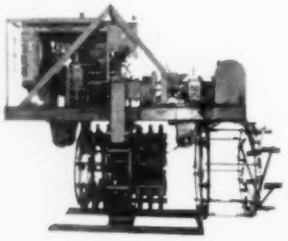
Specify

MYOCO

CLEANING and PRIMING MACHINE

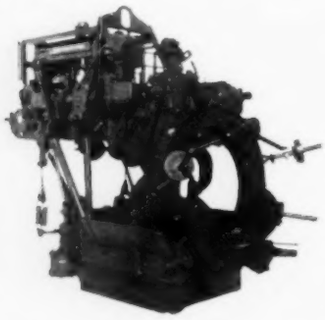
The MYOCO Cleaning and Priming Machines are available in sizes 3" thru 36". Pictured here is the 26"-32" size with two counter-rotating heads featuring the special MYOCO design counter-rotating gear box.

It is powered by an International U-9 self-starting engine and uses the Ramsey transmission. Engine exhaust is utilized to heat primer tank.



COATING and WRAPPING MACHINE

The MYOCO Coating and Wrapping Machine is powered by an International gasoline engine, with electric starter, spray type shoes, and heavy-duty transmissions and clutches. This new machine features under-pressure-crawler wheels equipped with hydraulic cylinder to maintain positive contact, easily controlled by the operator.



When you use MYOCO pipeline equipment, you quickly find that servicemen are experienced and available twenty-four hours a day with fast transportation available to serve you in any way; efficient equipment operation is assured by periodical checks; and if possible, parts and supplies are shipped the same day ordered.

MORRIS-YOUNG-OWENS CO. PIPELINE EQUIPMENT AND SUPPLIES MYOCO

MORRIS-YOUNG-OWENS CO.

PIPELINE EQUIPMENT AND SUPPLIES

14000 South Main Street • Houston, Texas

PArkview 3-0110

In Canada: MYOCO LIMITED, 30 Bloor St. West

Toronto 5, Ontario, Canada • Tel. WA 2-9444

What's Happening among SERVICE and SUPPLY MEN

SIE Names Newton Armstrong Systems Development Manager

Newton E. Armstrong has been appointed manager, systems development division of Southwestern Industrial Electronics Co., a Division of Dresser Industries, Inc.

N. E. Armstrong

Armstrong previously had been product manager, control division. His area of responsibility now includes the development and production of devices, instruments and systems by SIE for control applications in the pipe line, petrochemical and process industries.

Before joining SIE in 1952 Armstrong had been with IBM.

Maintenance Engineering Corp. Announces Several Appointments

Maintenance Engineering Corporation announces several changes in executive personnel. W. J. Peddie, formerly president, has been named vice chairman of the board. Howard Park, vice president since 1957, was elected president, and G. W. Gauthier, vice president, was made general manager.

Howard Park

E. B. Haldman has been re-elected vice president and general sales manager and B. I. Thorngren was appointed vice president in charge of chemical engineering. Elected vice president in charge of mechanical engineering was W. H. Leverett.

Standard Pipeprotection Inc. Names Wilson Vice President

John B. Wilson

John B. Wilson has been elected to the newly created post of executive vice president of the Standard Pipeprotection Inc.

Lee A. Whitney, vice president of Champlin Oil & Refining Co., was elected to the board of directors. Wilson, former vice president and treasurer, has been with the company since it was founded in 1949.

Jones Named Representative By Perrault Equipment Company

H. M. Jones

H. M. Jones has been named Houston representative for Perrault Equipment Company, it was announced by W. O. Dixon, owner of the firm.

Jones has served with several major pipe line contractors and is a former field representative of a pipe line magazine.

Le Roi Division Appoints Koehler General Sales Manager

Richard H. Koehler has been appointed general sales manager of the LeRoi Division of Westinghouse Air Brake Co., succeeding Jack E. Heuser. Koehler moves into the new position from the staff of the president of Westinghouse where he had been director of advertising and publicity. He will direct sales effort for all products of the division from Milwaukee.

R. H. Koehler

He has been with Westinghouse since 1952.

Caterpillar Tractor Co. Names Hasten Supervisor

Jack A. Hasten, district representative in the central sales division of Caterpillar Tractor Co., has been appointed supervisor of the Track-Type Tractor section of the sales development at Peoria, Ill.

Jack A. Hasten

Hasten has been associated with Caterpillar since 1942 and has served the past two years as district representative in sales territories of Burford-Toothaker Tractor Co., Montgomery, Ala., and Thompson Tractor Co., Inc., Birmingham, Ala. Previously he had served three years as engine representative in the central sales division.

IF YOU USE VALVES

YOU NEED THIS CATALOG!

Kerotest has been producing highest quality valves for the past 50 years for customers all over the world. Our new catalog—just off the press—gives dimensions, specifications and working tables to help you specify the right valves for refinery, industrial and marine applications.

Send for your copy—today!

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Write for Bulletin

PIPELINE VENTS AND MARKERS

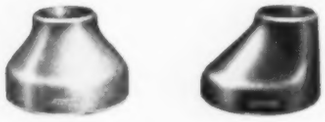
FLEET-LINE CO.
P. O. BOX 276-K
SHREVEPORT
LOUISIANA

Write for Specifications Folder

FLEET-LINE®

WELDING FITTINGS

REDUCERS: Concentric and eccentric. Nominal pipe sizes 1" to 30", ASA B16.9, ASTM A234. Schedules 10 to 160, stainless steel, and other alloys. Special lengths and sizes.



SADDLES: Conventional, and for pressure vessel heads. Nozzle sizes from ¼" to 24". Fleet-Line saddles weld neatly into place in much less time, and with much less welding rod.

Complete encirclement saddles.

Fast interested service.
Write for Literature.

STEEL FORGINGS, Inc.

P. O. Box 276K • Shreveport, La.

Allis-Chalmers Announces Three District Appointments

Allis-Chalmers Manufacturing Company announces three appointments in its Industries Group districts.

Bruce C. Halsted has been appointed manager of the Richmond district, succeeding J. M. Mathews. Malcolm S. Jones has been named manager of the El Paso district and Stanley S. Scott becomes sales representative for the Houston district.

Halsted joined Allis-Chalmers in 1941, and has been with the Richmond district since 1946. Jones, who has been with the firm since 1949, had been sales representative in the Denver district since 1951. Scott joined the company in 1953 and has been an application engineer in the firm's compressor department.

B. M. Maroney Joins J. A. Halpine & Sons, Inc.

B. M. Maroney has joined the J. A. Halpine & Sons, Inc. firm as vice president in charge of engineering. Maroney had been with Gulf Refining Co., the past eight years in the production division. Previously he had been in the pipe line department as northern division engineer. He was resident manager in Canada during planning, design and construction of Canadian Gulf Pipe Line Co.

B. M. Maroney

Prior to his service with Gulf he had been an engineer for six years with Carter Oil Company and an engineer and division manager for five years with Kobe, Inc. J. A. Halpine & Son, Inc. plans to expand its activities to include consultant engineering in transportation, production, and equipment development.

Henry Holguin

R. E. Harber

MKY Corp. Names Holguin And Harber Vice Presidents

MKY Corporation recently opened its Houston district office and has appointed two vice presidents. Henry Holguin, vice president, foreign operations, and R. E. Harber, vice president, general manager, opened the Houston office at 6316 Long Dr. MKY's home office is in Tulsa with another district office at Odessa.

President Bill Morrison announced that Holguin's headquarters will be in Houston and Harber's offices will be in Tulsa. MKY manufactures pipe line pigs for repairing lines.

C. R. Conklin Promoted By Republic Rubber Division

C. R. Conklin has been promoted to assistant general sales manager of Republic Rubber Division of Lee Rubber & Tire Corporation. He succeeds J. M. Hughes.

Conklin joined Republic as a salesman in 1926. He was appointed eastern district manager in 1947 and held that position until his recent appointment.

Collins Radio Company Announces Appointment of Oliver J. Greenway

Collins Radio Company has named Oliver J. Greenway as general manager of Communications Accessories Company, a subsidiary located in Lee's Summit, Mo.

THE GOODMAN CYLINDRICAL STOPPER

FOR GAS, OIL, WATER AND DRAIN PIPES

The Goodman Cylindrical Stopper is an inflatable bag with a rugged water-proofed casing which may be inflated to a high internal pressure and will hold against as much as ten pounds pressure in the pipe.

The broad central zone makes contact with the wall of the pipe and holds against a higher pressure than other types of bag.

This Stopper has been used successfully for testing soil pipes in new buildings and for stopping oil pipes around refineries. Water-works engineers use it to save pumping while altering or repairing mains where leaky valves are encountered. It is now giving satisfaction in sewer work, and in at least one instance it saved a city water-works a large expenditure of money.

Safety Gas Main Stopper Co., Inc.

523 ATLANTIC AVENUE
BROOKLYN 17, N. Y.

WHY PEDRICK'S

Conformable

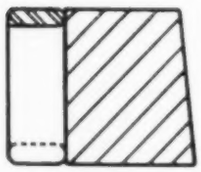
TAPER-FACE COMPRESSION RING

GIVES MAXIMUM PERFORMANCE IN BIG-BORE ENGINES

Recommended especially for 4-cycle engines.

Big reason is unusual conformability of this Pedick design under every sort of cylinder condition. This important advantage is the result of Pedrick's exclusive "Equalizer" steel expander ring that exerts a uniform pressure all around the cast-iron cylinder contacting ring. The cast-iron section is radially thinner, much more flexible.

The taper-face of this conformable compression ring initially provides a line contact with the cylinder wall. You benefit from higher unit pressure, quicker seating and sealing, less chance of scuffing the cylinder wall.



TF7 DESIGN
U.S. Patent No. 2,771,329

The TF7 design shown here is one of the many *specialized* designs developed by Pedrick to provide users with the best combination of rings for maximum results in each installation. The right ring in the right place is your best guarantee of long-lived, dependable, low-cost operation. You're invited to call on our Engineering and Consulting Service to help you solve your particular ring problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa., Tel.: SAratoga 9-3770. *Canadian readers:* Wilkening Manufacturing Co. (Canada) Ltd., Toronto 2.

Pedrick PISTON RINGS

PEDRICK PIONEERED *conformable* RINGS FOR BIG-BORE ENGINES

For more data on advertised products, use Readers' Service Cards, last page.

PIPELINE OPERATORS

WRITE FOR BRIGGS' special catalog devoted entirely to your field. It covers fuel and lube oil filtrations . . . fully describes, with diagrams and field data, the removal of contamination from compressed air and gas . . . has up-to-date facts on the most efficient method for the separation of water, dirt and oil.

EVERY PAGE is "engineer written" . . . packed with flow rates, charts and illustrations and technical data that can be immediately employed to save you time and costly shut-downs. No obligation, of course. **SEE US IN OUR BOOTH #205 AT THE INTERNATIONAL PETROLEUM EXPOSITION, TULSA, OKLAHOMA.**

Briggs — PIONEERS IN MODERN OIL FILTRATION

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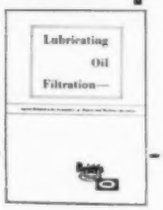
FILTER/SEPARATORS
COMPRESSED AIR/GAS FILTERS

EVERY REQUIREMENT FOR THE PIPELINE INDUSTRY

PRODUCT OF BOWSER RESEARCH



THE BRIGGS FILTRATION COMPANY DEPT. 300
WASHINGTON 16, D. C.

YES! Send me your special pipeline operators catalog. No obligation.

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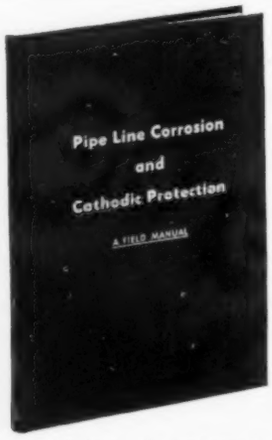

The most practical on-the-job manual for men concerned with pipe line corrosion.

Pipe Line Corrosion and Cathodic Protection

By MARSHALL E. PARKER

This book is designed as a practical field manual. It provides workable methods that can save you valuable time and effort in obtaining interpretive field data.

Contents (Condensed). Soil Resistivity Surveys, Pipe-to-Soil Potentials, Line Currents, Current Requirement Surveys, Rectifier System for Coated Lines, Ground Bed Design and Installation, Magnesium Anodes on Coated Lines, Hot Spot Detection, Stray Current Electrolysis, Interference in Cathodic Protection, Operation and Maintenance, Coating Inspection and Testing.

Appendices cover: Fundamentals of Underground Corrosion, Basic Principles of Cathodic Protection. Plus . . . tables and properties of metals, attenuation equations and index.

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Greenway has had several years experience in manufacturing, sales, and management with Westinghouse Electric Company and Ward Industries. He also served for 12 years with International Resistance Company as vice president.

W. S. Rockwell Co. Names Two Sales Representatives

W. S. Rockwell Company announces that Rawson & Co., Inc., Houston, and The Rawson Company, Inc., Baton Rouge, La., have been named sales representatives on Rockwell butterfly, slide and special valves in South Texas, Southern Louisiana and Southern Mississippi.

Sales representatives in the Houston office are W. B. Rawson, Robert Houlihan, R. E. Moore and L. F. Washburn. The Baton Rouge office is under direction of James H. Simpson, Jr.

Grove Valve & Regulator Co. Names Huddle Sales Engineer

Jack Huddle

Jack Huddle has been appointed to the sales engineering staff of Grove Valve and Regulator Company, it was announced by George C. Doty, vice president and general manager.

Huddle will be headquartered in Grove's Odessa, Texas, office.

Southern Engine & Pump Co. Appointed Wheatley Representative

Southern Engine & Pump Co., Houston, has been named the Gulf Coast sales and service representative for the entire Frank Wheatley Corp., piston and plunger pump lines.

The company will offer exclusive Wheatley sales and service representation from New Orleans, Corpus Christi, and San Antonio, Texas. Wheatley pump line also will be sold from offices in Beaumont, and Edinburg, Texas, and Lafayette, La.

Bob White, previously with Wheatley, will join Southern Engine & Pump Co.

Parkersburg Rig & Reel Co. Holds Sales Meeting in Houston

Nearly 100 key executives and sales representatives of the Parkersburg Rig & Reel Company attended the firm's sales meeting in Houston, recently.

B. P. McConough, president of Parkersburg, was main speaker of the meeting. Theme of the meeting was "Sell 'em Parkersburg!" meaning the entire line of steel tanks, prefabricated buildings, etc.

Robert C. Bryan Joins Youngstown Sheet and Tube

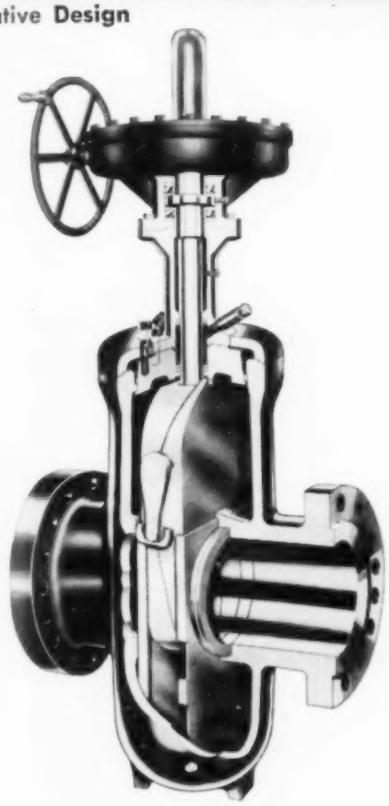
Robert C. Bryan has joined the staff of the comptroller of Youngstown Sheet and Tube Company as manager of a new department of systems and procedures.

The department will service all departments of the company and assume the responsibility for improvement of paperwork control and administrative systems by manual, mechanical and electronic techniques.

Bryan formerly had served with Blaw-Knox Co. and Jones & Laughlin Steel Corporation.

W-K-M's *Creative Engineering*

Creative Design | Precision Manufacturing | Rigorous Testing



...Your extra assurance of dependable performance

W-K-M's creative engineering is a continuous process that begins with a study of pipeliners' valve problems. It proceeds to design . . . extends through production . . . reaches a climax with the most rigorous testing procedures in the business: Every W-K-M valve passes tests that go far beyond the requirements of your operations.

W-K-M ASA Gate Valves are the best you can use in pipeline service. No other valves compete in design or quality of production.

For performance you can depend on, specify W-K-M when you requisition valves.

W-K-M® ASA Gate Valves

Features include: Parallel expanding gates • Through-conduit • Exclusive gate centralizer • Replaceable seats • Pressure seal bonnet • Lubricated seats • Two thrust roller bearings • Super-finished stems.

Design assures: No-surge operation • No turbulence • No pressure drop • Free passage of pigs or scrapers • Easy operation • "On-the-line" overhaul.

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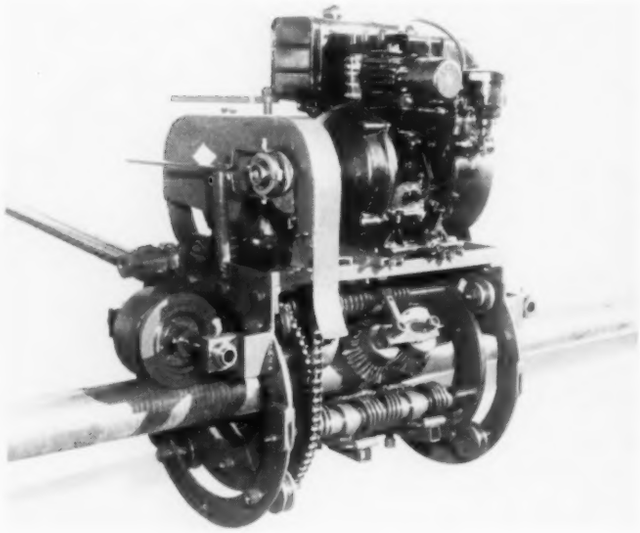
What's New in EQUIPMENT

To receive more information on all new equiment articles use Readers' Service Card, last page of this issue.



Pipe Cleaning Machine

The new Remco self-propelled pipe cleaning machine is desined for new pipe as well as for maintenance and repair work on existing pipe. It is capable of cleaning up to 25 feet per minute and requires but 6 inches of clearance under the pipe.

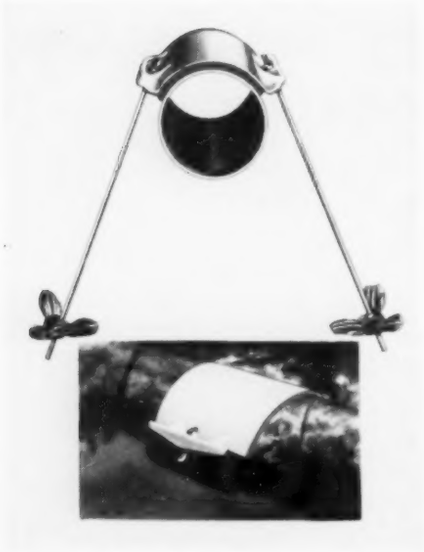
The compact unit can be installed by two men; it can be used on oil, gas or products lines in service since it is lightweight and nearly vibrationless.

Once attached to the pipe it can be operated by one man. It has one reverse and two forward speeds; travel of machine and rotation of cleaning head are independent, permitting the operator to exercise better control over the operation. Design of cleaning head allows passage over collars, patches and bell and spigot pipe. The machine uses standard knives, cutters and flat, steel back brushes and Remco rotary cup brushes.

The cleaning machine is available in four models; each will clean four successive sizes from 2-inch to 30-inch. Larger models are available on special order; primer attachment, taping attachment, stationary base, recoil starter and cup brushes can be supplied.

(This item supplements Remco Manufacturing Co. data on pages 374-375 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E1** on Readers' Service Card, last page this issue.



Pipe Line Anchors

Grip-Tite Company has developed a positive expanding anchor and pipe saddle for anchoring pipe in marsh lands. It is designed for protection to pipe coating and permanent hold-downs of all kinds of pipe line construction.

The assembly is made of malleable iron and the pipe saddle consists of 10-gage sheet metal, hot dip galvanized after stamping the assembly tested in soil.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

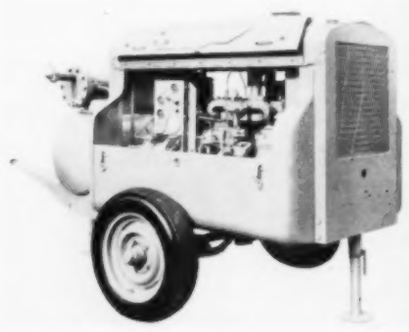
Spark-Ignited Engine

A new, spark-ignited engine, designed to operate on a wide variety of gaseous fuels, has been announced by Engine Division, Caterpillar Tractor Co.

The Cat D342 Series C is the third model in the line of spark-ignited engines. Two compression ratios are available, 10:1 for high efficiency operation with methane type gases and 7.5:1 for use with liquefied petroleum or field gases.

To be shown at the International Petroleum Exposition, Tulsa, May 14-23.

For more data, circle **No. E3** on Readers' Service Card, last page this issue.

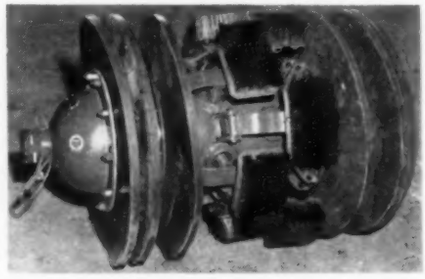


Rotary Air Compressor

The Jaeger Machine Company has introduced a 75 cfm rotary air compressor. Completely vibration free, the unit delivers 75 cfm of air at constantly maintained 100 pounds pressure and much cooler temperature. It is air cooled with a gasoline engine and has a full load speed of 1,750 rpm.

Simple, instant-acting precision controls insure constant air pressure under all normal demands and prevent over-run and engine racing.

For more data, circle **No. E4** on Readers' Service Card, last page this issue.



Collapsible Pig

A new collapsible pig, designed for use on pipe lines with two diameters or with smaller inside diameter full opening valves, has been announced by Morris-Young-Owens Company.

This pig features spring loaded brushes and collapsible rubber discs, with the body of aluminum castings. MYOCO states that the pigs are available in four sizes.

(This item supplements Morris-Young-Owens Co. data on pages 297-300 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E5** on Readers' Service Card, last page this issue.

Vertical Pumping Motor

Designed for easier installation and maintenance in industrial pumping application, a vertical motor has been announced by General Electric Company.

New design features include oversize oil filler hole, large drain plug, easy access conduit box, oil level slight gage and a lightweight top cap. The full line has ratings from 7½ to 125 horsepower at 1800 rpm.

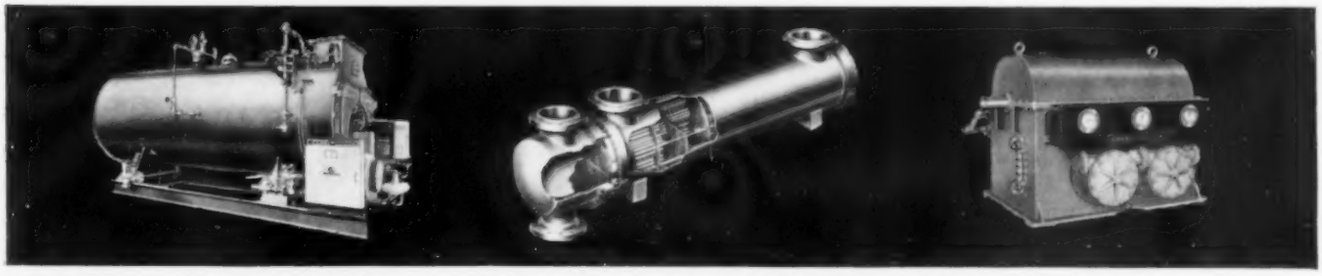
(This item supplements General Electric Company data on pages 199-202 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E6** on Readers' Service Card, last page this issue.

Calling in equipment representatives on your pumping-station job?

Be sure <u>one</u> of them
is from
AMERICAN-Standard
Industrial Division

You benefit by discussing equipment-selection with an engineer. American-Standard* Industrial Division is engineer-staffed from brass to branches. Combining three American-Standard divisions—American Blower, Ross Heat Exchanger, Kewanee Boiler – this new organization offers *one-source responsibility* for quality and performance in equipment designed, engineered, and manufactured to work together. There are offices in all principal cities; contact the one nearest you. American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario.



Firebox, scotch-type steel boilers and package units for heat, power, steam.

Heat exchangers, condensers, and feed-water heaters for every requirement.

Fluid drives for adjustable-speed control of pumps and fin-fan coolers.

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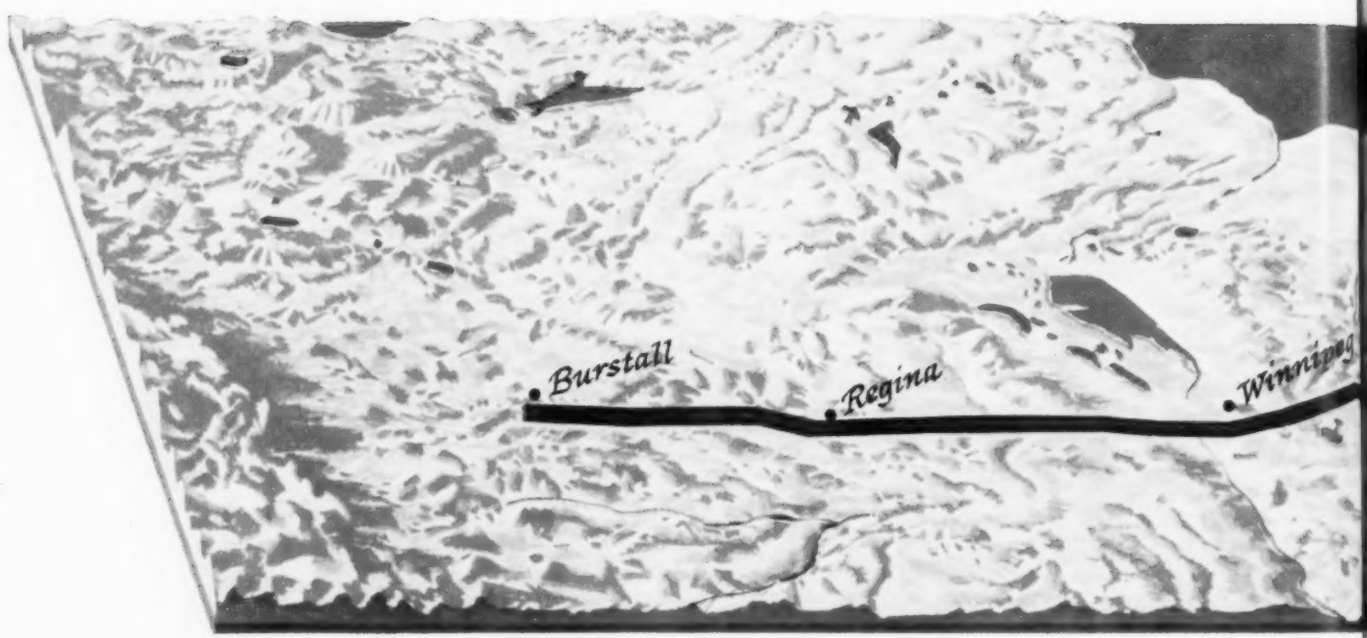

Trans-Canada Pipe Lines completed ahead of schedule despite shifting sands, diamond-hard rock, white water and tricky muskeg

This immense project began in 1954 when 76 miles of 20-inch pipe was laid from Niagara to Toronto. Since then — construction has proceeded ahead of schedule and within estimated costs. Today, Alberta natural gas, rather than gas from American sources, can be delivered at rates of 620 million cu. ft. a day through the main 30- and 34-in. line.

The line spans turbulent rivers, the Great Sand Hills, hard rock and spongy muskeg. Frequently, the work progressed despite temperatures to 48° below zero.

A. O. Smith was one of the major suppliers of pipe for this 2290-mile line which is now delivering natural gas to homes and industries along its route — an area containing three-fifths of Canada's population.

For over 30 years . . .

A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe, made and installed in 1928, is still in operation. That's why so much A. O. Smith pipe is in nearly every important high-pressure line.

90 → miles!

Spanning 2290 miles, the Trans-Canada line reaches from the Province of Alberta to Montreal . . . and proposed additions will extend the line as far east as Quebec.

Typical of nature's efforts to thwart completion of the line were temperatures ranging to 48° below zero. Nevertheless, work progressed ahead of schedule and below estimated costs.

The formidable Laurentian Shield was blasted, ripped, drilled and shattered to make way for Canada's longest natural gas pipeline. Going was rough, but the rewards for Canadians were far greater.

Through research A.O. Smith *. . . a better way*

A.O.Smith
CORPORATION

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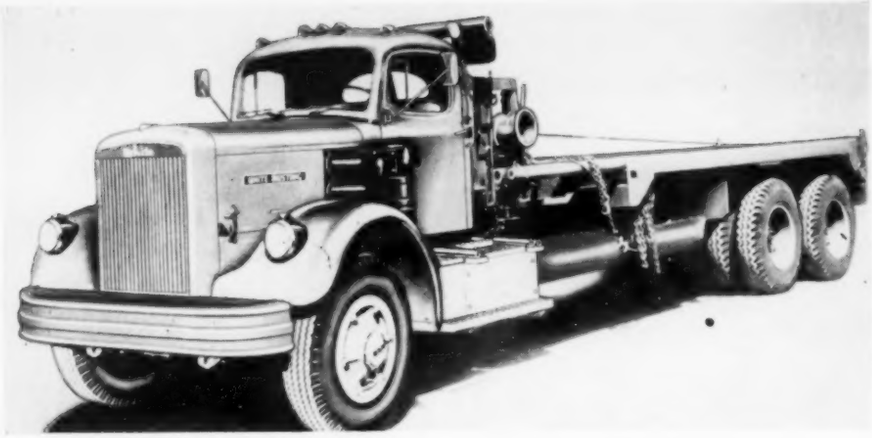
For more data on advertised products, use Readers' Service Cards, last page.



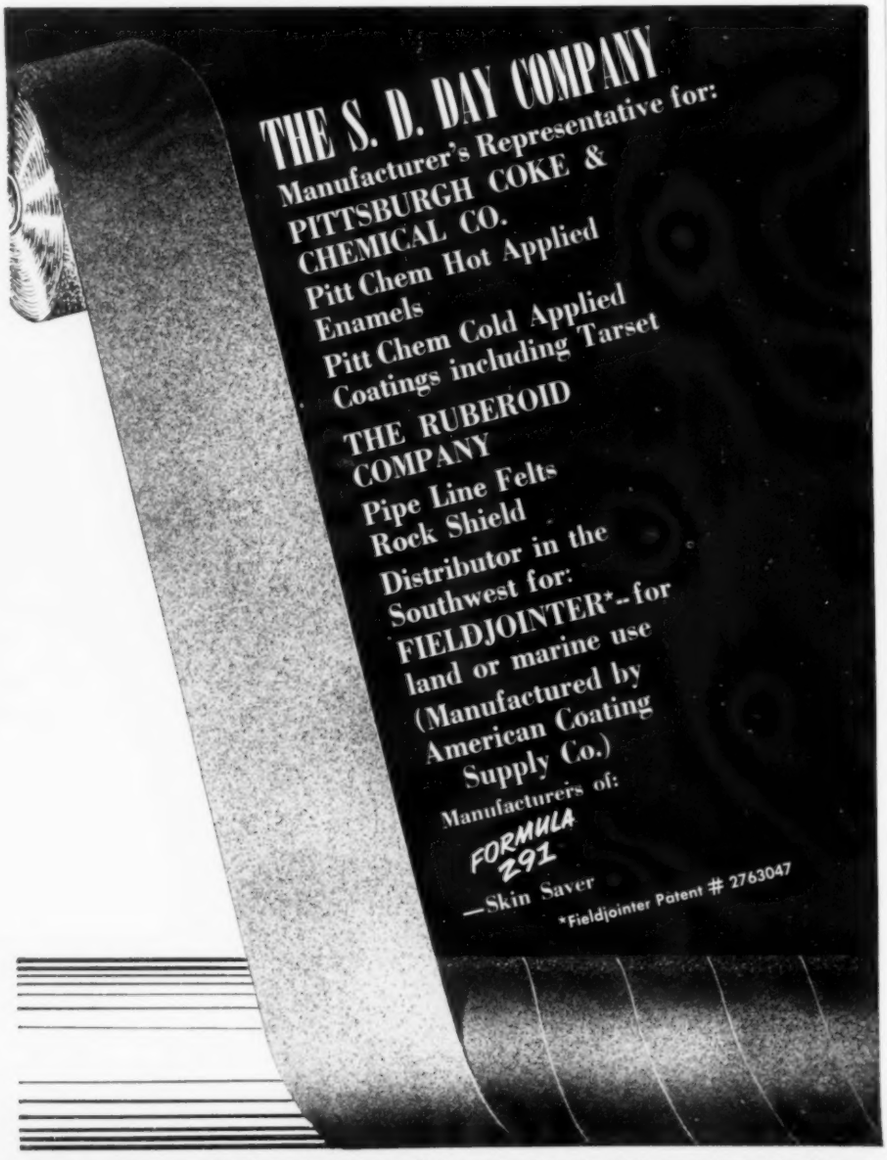
Heavy-Duty Trucks

White Motor Company announces five new heavy-duty trucks and transport tractors. The White 4264 has a gas engine developing 215 hp at 2,900 rpm, and 410 pounds ft. torque at 1,200 rpm. Transmission is White's five-speed 541B coupled with an 8031A three-speed auxiliary transmission with power tower for heavy-duty winch operations.

The 4200T is powered with a gas engine with 172 hp at 3,200 rpm, and 315 pounds ft. torque at 1,400 rpm. The unit will have 502B five-speed transmission and 329C two-speed planetary-type rear axle. The White 5000 fiberglass-cab tractor over-the-road transporter contains all mechanical components within a 50-inch length. The diesel engine is rated at 180 hp at 2,100 rpm and 504 pounds ft. torque at 1,525 rpm. White also introduces its new 9000 TL, a lightweight tractor highlighting the use of aluminum for transmission main case, brake spiders, air tank, air compressor case, bumper, steering case housing, hood, air cleaner housing, radiator frame, fuel tank, quick release valves and other parts. It is equipped with a 10-speed transmission, 8,500-pound-capacity front axle and single reduction rear axle with 80,000 pounds rated capacity. The new autocar, DC20464S-OH is equipped with a diesel engine developing 220 hp and has a four-speed transmission and four-speed auxiliary transmission. To be shown at International Petroleum Exposition, Tulsa, May 14-23.

(This item supplements White Motor Company data on pages 525-528 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E7** on Readers' Service Card, last page this issue.



Repair Kit

Taylor and Art, Inc., Plastics announces a repair kit for industrial maintenance use. Liquid and plastic compounds in the kit solidify to adhere and lend strength to fractures, holes, or dents in metal, wood, plastic or other materials.

The kit contains a paste-type plastic resin; a liquid plastic resin; fiberglass cloth and necessary tools and brushes. A catalyst is used to cure the resin and make it a strong, adhesive material. The fiberglass cloth and liquid resin are combined for repairs on large holes and tears. The compounds will not rust or corrode.

For more data, circle **No. E8** on Readers' Service Card, last page this issue.

MEET US IN TULSA

AT THE
INTERNATIONAL PETROLEUM
EXPOSITION · MAY 14 to 23
BOOTH 78N and 79N

STEWARTS AND LLOYDS, the British manufacturers of oil country goods, line pipe, refinery and chemical plant pipework and fittings invite

YOU

to visit their booth, Nos. 78N and 79N at the Tulsa Exposition. S & L are one of the leading steel pipe manufacturers in the world. S & L employ 42,000 people in Great Britain and have associated and subsidiary companies in other parts of the world.

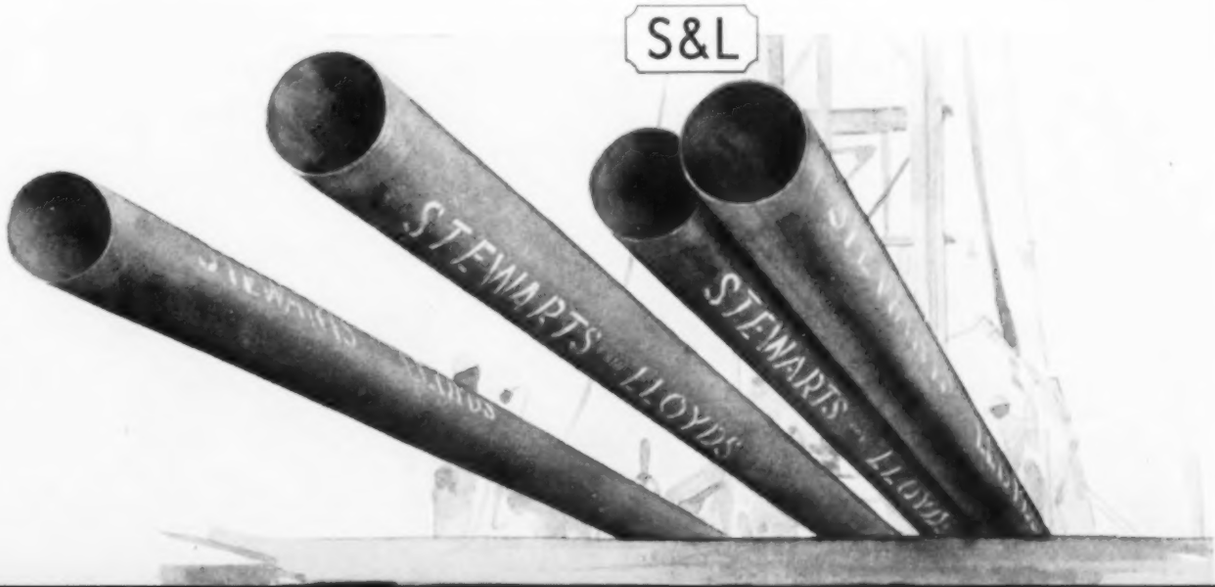
Since S & L mine the iron ore from which the steel pipes are made, the company's research and production engineers are able to maintain quality control from start to finish in the iron and steel works and pipe mills which are laid down for flow line production.

For very many years, the name of Stewarts and Lloyds has been synonymous everywhere with the highest quality in casing, tubing and line pipe for the oil and natural gas industries and pipes and fittings for the refining and chemical industries.

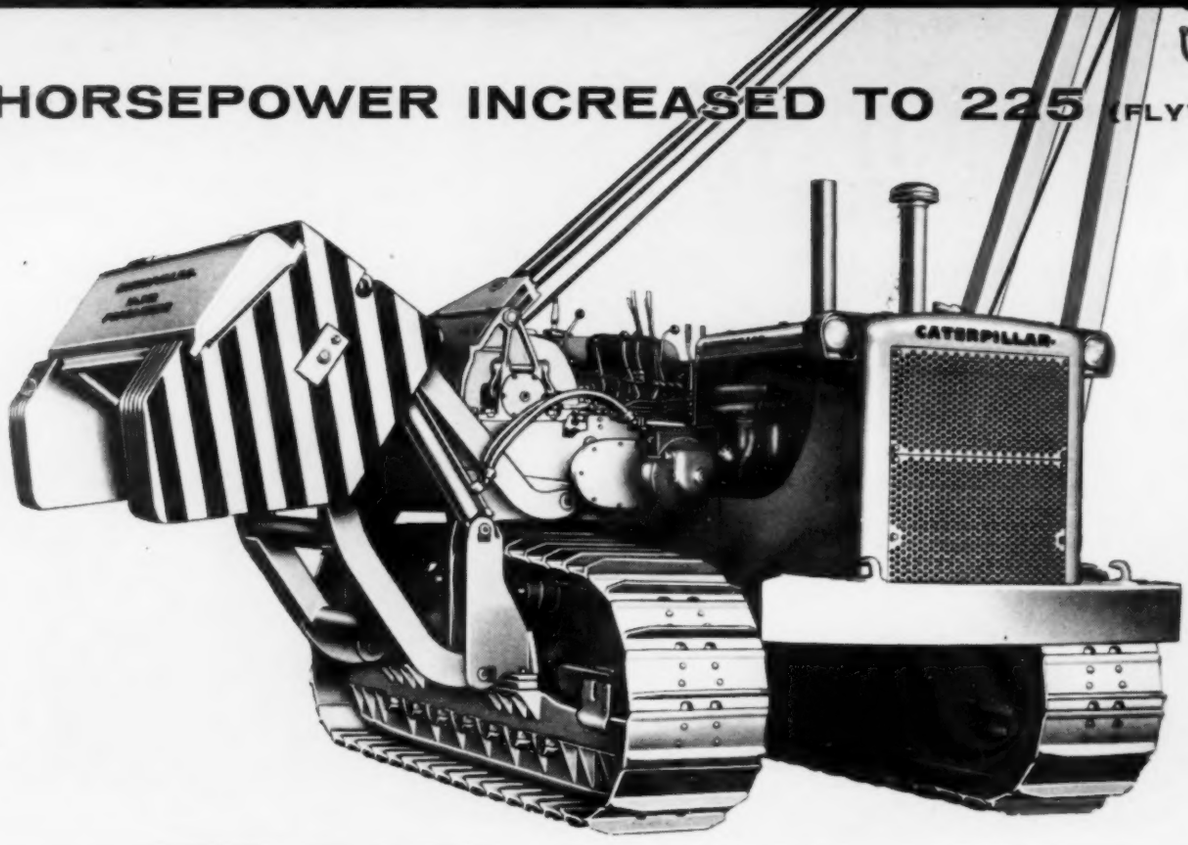
If you are visiting Tulsa, S & L hope you will accept this invitation to visit their booth where they will be privileged to discuss their products with you.

STEWARTS AND LLOYDS
LIMITED

'O' DEPARTMENT, GOUGH SQUARE,
FLEET STREET, LONDON, E.C.4.



HORSEPOWER INCREASED TO 225 (FLYWHEEL)



CATERPILLAR'S **PROJECT PAYDIRT**

PROJECT PAYDIRT pays off for you

NEW TURBOCHARGED

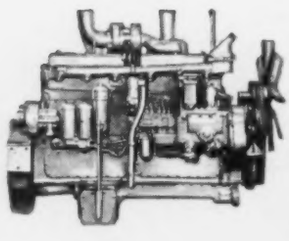
The Caterpillar No. 583 Pipelayer, the standard of spreads around the world, now is bigger, more powerful, more productive than ever. It's another major achievement in Caterpillar's all-out research program, "Project Paydirt" (see box below).

The strongest pipelayer of them all is completely new—in design, appearance and performance. It incorporates dramatic new engineering advances. It is easier to operate.

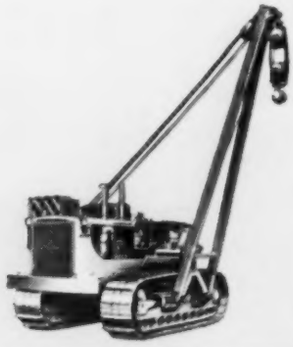
What will it do on your spread? Here's the answer:

The new No. 583 Series H has a lifting capacity of 137,000 lb.—an increase of 7,000 lb. Its counterweight suspension has been redesigned to make this possible.

No matter what terrain the pipe takes you through, ground clearance of the No. 583 is well known. Now with it comes greater stability. Tractor gauge has been increased from 86 to 90 inches. Ground contact, with 28-inch shoes, has been increased to 7,220 sq. inches.

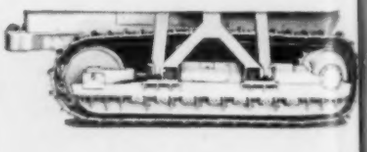


HORSEPOWER INCREASED 18%. The horsepower of the new No. 583 is up from 191 to 225 at the flywheel. In addition, over-all engine performance has been greatly improved by the addition of the efficient job-tested Caterpillar Turbocharger.



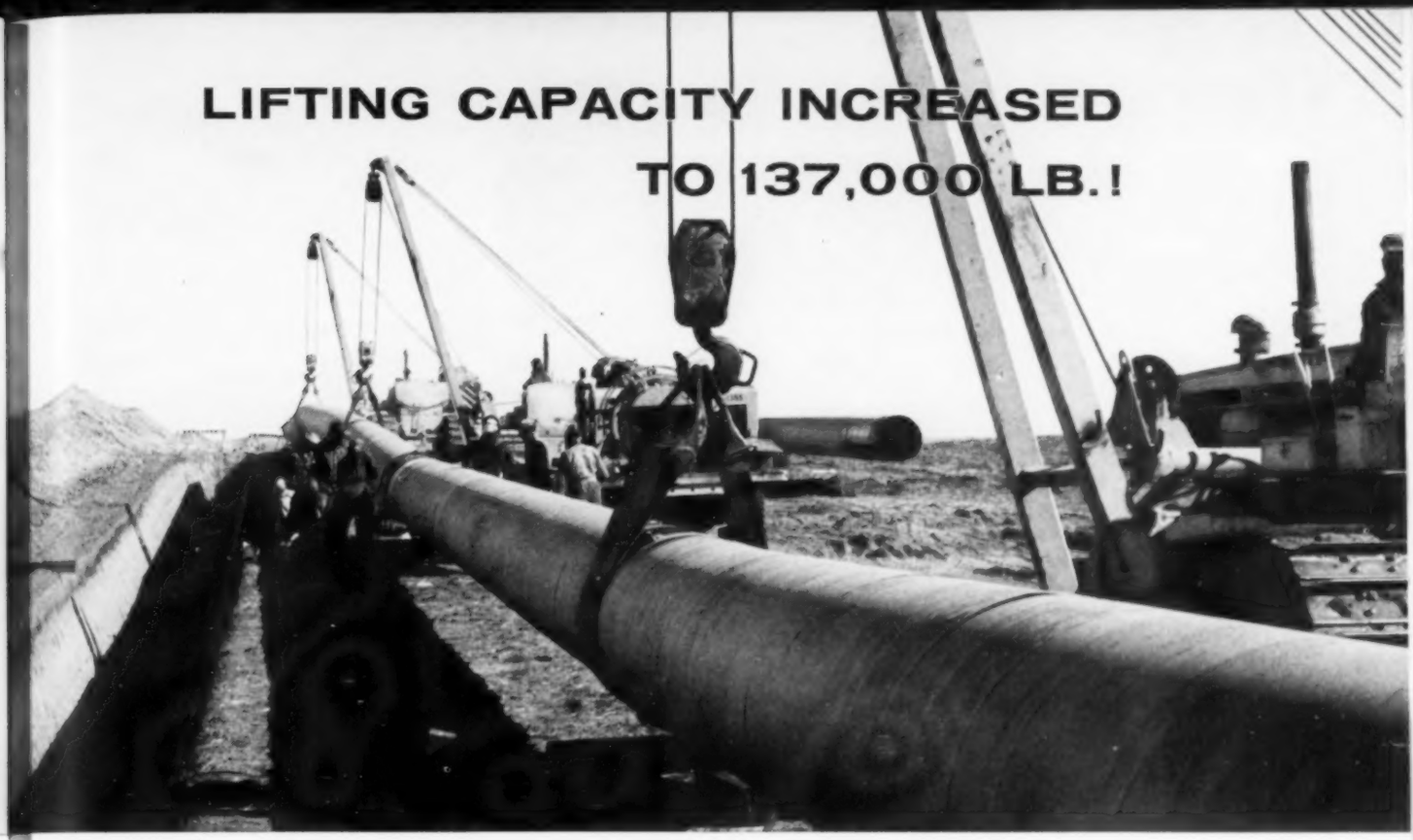
SIZE INCREASED. To make effective use of the new horsepower, over-all weight of the pipelayer has been increased 5,800 lb. to a total of 83,800 lb. Increased size means more lifting capacity. Capacity is now 137,000 lb.—an increase of 7,000 lb. In addition, counterweight suspension has been redesigned.

LIFETIME LUBRICATED ROLLERS AND IDLERS. That's right—lifetime! In a major research breakthrough, Caterpillar has achieved track and carrier rollers and idlers that never require further lubrication until rebuilding. And service life is hundreds of hours longer than with ordinary rollers.



NEW, STRONGER, HEAVIER UNDERCARRIAGE. Every component, such as frames, links, braces, pins, bushings, shoes, has been made stronger by the use of improved materials and heat treat processes to provide longer life. And 21 inches of ground clearance—a key feature—has been retained.

LIFTING CAPACITY INCREASED TO 137,000 LB.!



NO. 583 SERIES H PIPELAYER

These are only a few improvements on the new No. 583 Series H that will enable you to handle pipe faster. You will get higher production, yet the new machine is actually more economical to own and operate.

Find out for yourself. Get the full story from your Caterpillar Dealer, all the facts and figures that can only be touched on briefly here. Then see this great new machine at work on your spread as soon as possible.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR

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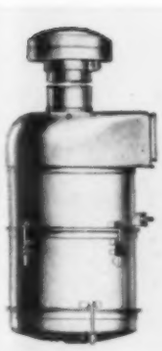
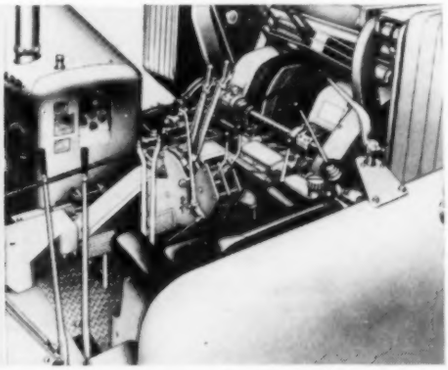
BORN IN RESEARCH... TESTED IN THE FIELD



DRY-TYPE AIR CLEANER. Another major Caterpillar research development on the new No. 583—the new dry-type cleaner removes 99.8% of dirt in the intake air even under severe operating conditions, means greater engine protection. The new cleaner can be serviced in 5 minutes, costs a good deal less to use.



SUPERIOR OPERATION. Pipelayer controls are conveniently located with "console" mounted levers for the winches. With this new control grouping, it's easy to get accurate cradling while maneuvering the machine. And operator visibility is even better than before because of narrower dash.

MINIMUM SERVICE NEEDS

Here are just a few of the new features that reduce maintenance time:

- Greater cooling capacity.
- Double-reduction final drive to extend life of transmission, bevel gear and pinion, steering clutches and brakes.
- Transmission, steering clutches and brakes get filtered, cooled oil under pressure for longer service life. A Caterpillar exclusive.
- No steering clutch adjustments are necessary.
- Transmission, bevel gear and steering clutches have a common lube system that uses engine oil.

CATERPILLAR'S **PROJECT PAYDIRT**

PROJECT PAYDIRT: Caterpillar's multi-million-dollar research program to meet the coming challenge of the greatest construction era in history with the most productive machines ever developed.

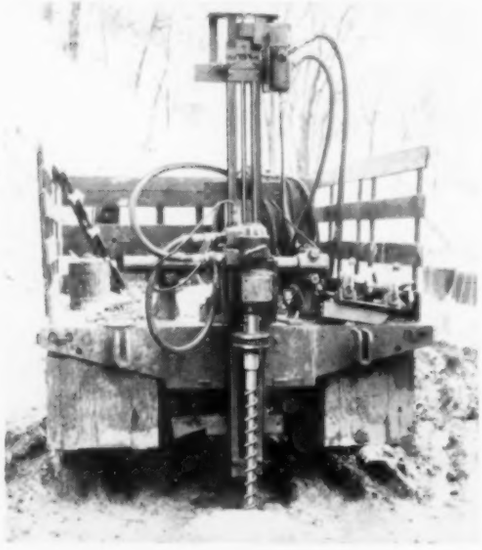
KA-MO has the answer to your drilling problem

48-foot bore —

To run a gas distribution line under main highway, the pipeline contractor on this job used a portable Ka-Mo horizontal drill . . . quickly bored a 12" diameter hole, 48' long, through hard clay. Drill was powered by a 7½ h.p. air motor on a standard double-track mounting. On similar type work, casing can be installed at the same time hole is drilled by using the casing attachment which provides maximum protection against costly cave-ins.

Ka-Mo offers tremendous versatility . . . light, portable drills . . . easy to operate for installing gas lines under streets, highways, railroads. Drills through sand, clay, gumbo, frost, shale, limerock, other mineral formations. Air, electric, hydraulic, diesel or gasoline engine powered.

Vertical drilling for cathodic pipe protection



Ka-Mo truck mounted hydraulic unit used to simplify installation of anodes. This drill is available in sizes from 6" to 24" diameter. Gravity or pressure feed.

Next time you have a drilling problem, check the Ka-Mo line. Drill sizes: 2" to 48" dia. and larger, in sectionalized lengths, are tailored to meet your own particular requirements. Information is available at no obligation. Just mail coupon today.

- - - - - - - - - - - - -

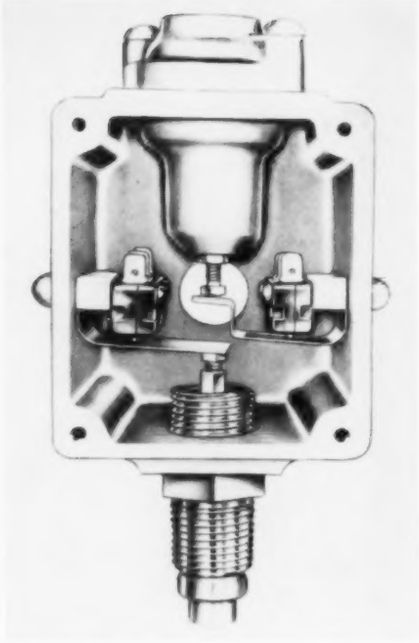
Mail to: KWIK-MIX CO., Ka-Mo Tools Dept., 1845 South 55th Ave., Cicero 50, Ill.

NAME .....
TITLE .....
COMPANY .....
STREET .....
CITY .....
STATE .....

Send free data on:
☐ horizontal ☐ vertical
☐ angular drilling equip.
☐ pipe anchor installation
Dia. of hole ..... inches
Length of bore ..... feet
Type soil .....

KAM904 PI

KWIK-MIX COMPANY — *Ka-Mo Tools Dept.*
A DIVISION OF KOEHRING COMPANY

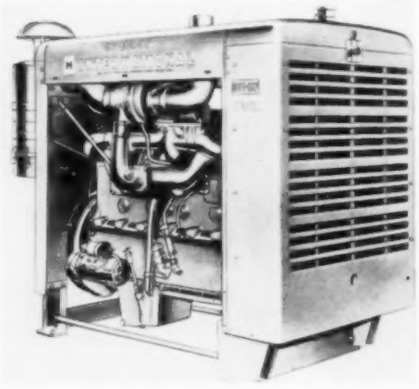


Safety Control Switch

Amot Controls Corporation announces a safety control switch which can be used as a warning on large compressors. It incorporates two single-pole, double-throw, snap-action switches. One switch reacts to high jacket water temperature, and the other to low oil pressure. The switch will sound an alarm, flash a warning light or shut down an engine if the jacket water temperature gets too high or lubricating oil pressure fails or gets dangerously low.

Switches are equipped with tab terminals and solderless type slip-on connectors are furnished with each unit to simplify the wiring job.

For more data, circle **No. E9** on Readers' Service Card, last page this issue.



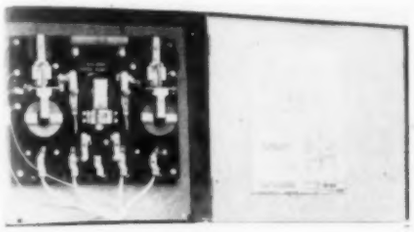
Diesel Power Unit

International Harvester Company announces its most powerful diesel unit, the UDT-817. The engine is a six-cylinder, turbocharged, four-cycle unit, with a 5⅜-inch bore and 6-inch stroke. The turbocharged model has a maximum horsepower of 385 at 2,100 rpm.

The heavy-duty engine is designed for application in all types of construction equipment, including rubber-tired earth-moving machinery. The UDT-187 incorporates such features as a fast direct start with 24-volt electrical system, direct injection of fuel under pressures to 20,000 psi by individual camshaft multi-orifice in-

jectors, and dual intake and exhaust valves for free breathing efficiency. A wide variety of accessories equipment is available for special installation.

For more data, circle **No. E10** on Readers' Service Card, last page this issue.

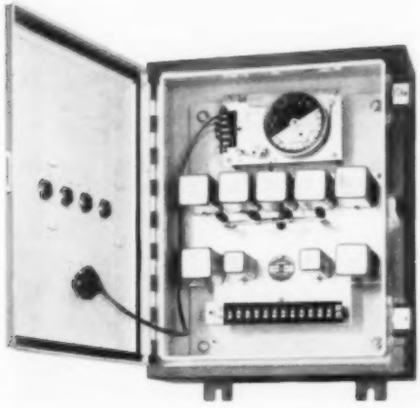


Load Demand System

Pacific Mercury has introduced its FAC-100 automatic load demand system for use with electric plants up to 4,500 watts.

The FAC-100 automatically starts the electric plant when equipment is switched on, automatically turns the power off when it is no longer required. When used with automatic line transfer switch, the automatic load demand system also insures a complete standby control system in case public power fails. The system automatically takes over when normal power sources fail, shuts itself off, automatically, when power is restored.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.



Program Timer Control

Synchro-Start Products, Inc. announces a new automatic control designed for use on gas, gasoline, or diesel engines. The program timer includes one of their standard automatic engine controls together with a timer driven by a governed dc motor.

All current is taken from the engine battery so that no commercial power is required for their operation. Many variations are available, including safety protection for all usual abnormal conditions. When an engine is equipped with the controls, it can be preset for the length of time, time of day or night and days of the week the engine is required to run, as well as the time it is required to be stopped.

To be shown at the International Petroleum Exposition, Tulsa, May 14-23.

For more data, circle **No. E12** on Readers' Service Card, last page this issue.

BIG Parsons® 420 Trenchliner...

Digs 36 to 52 in. wide... 7 1/2 FEET deep

Today you'll find the right answer to your cross-country work and other big trenching jobs in Parsons 420 Trenchliner®. Developed especially for big work schedules, it has the extra capacity, performance and dependability you need to open trench at lowest cost per lineal foot.

Digging from 36 to 52 inches wide at depths to 7½ feet, this heavy-duty wheel-type machine produces up to 25 lineal feet of trench per minute. With all this extra capacity you still get smooth, precision wheel control. Double-action hydraulic rams actuate digging wheel — give infinite depth selections, maintain close grade tolerance in toughest digging. Heavy-duty wheel has formed steel-plate buckets, solid or tine-back, with replaceable point-type teeth.

Hydraulic control system on conveyor gives belt speeds up to 621 feet per minute — *completely independent of digging wheel speeds.* Belt easily handles maximum yardage from the extra-wide wheel — puts spoil bank well back beyond edge of trench. See Parsons distributor, or write for more facts.

Need deeper trenches on your cross-country work? Then check this larger companion model 520 Trenchliner. It produces up to 28 lineal feet of trench per minute — 40 to 52 inches wide at depths to 8½ feet. Parsons offers a complete line of wheel and ladder-type Trenchliners. In addition to the 420 and 520, there are 3 smaller wheel types — and a choice of 5 heavy-duty ladder type Trenchliners.

Mail to: PARSONS COMPANY, NEWTON, IOWA *Send literature on:* ☐ 420 Trenchliner ☐ 520 Trenchliner

NAME_____

TITLE_____

COMPANY_____

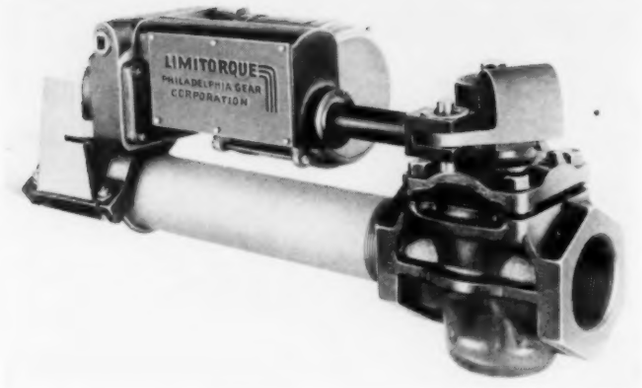
DIVISION_____

STREET_____

CITY, STATE_____

(A Division of Koehring Company) P932 PI

TRENCHLINERS for PIPELINERS



Motorized Valve Operators

Philadephia Gear Corporation announces a new type P-2 Limitorque motorized valve operator for use on small globe and gate valves. Hand operated valves can be motorized by removal of the hand-wheel, and mounting of P-2 unit on the same bonnet.

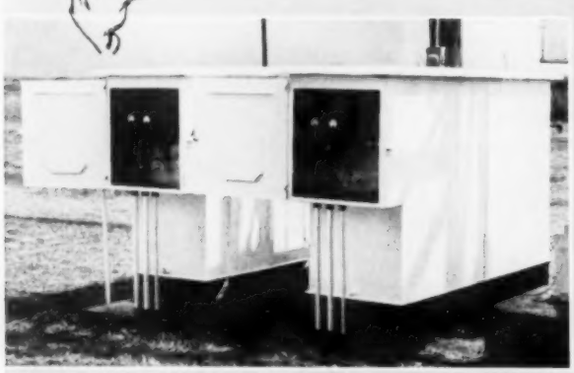
A Limitorque operator has also been introduced for mortorizing wrench operated plug valves. The linear operator consists of motor and double reduction gearing which drives a traveling screw and crank that is easily mounted to the square shank of the plug value. The entire assembly can be adapted to the plug valves in service, by mounting the crank on the plug shank and support bracket to the pipe (see photo).

For more data, circle **No. E13** on Readers' Service Card, last page this issue.

STOP CORROSION WITH B-K CATHODIC PROTECTION EQUIPMENT

CHECK THESE B-K RECTIFIER ADVANTAGES:

- Selenium stacks or Silicon Diodes derated for climatic conditions
- Heavy duty transformer
- All-welded, heavy-gauge steel case—double hot dipped galvanized
- Weston Type 506 D. C. Voltmeters & Ammeters, or equivalent



B-K Recifiers are Custom Engineered

COMPLETE CATHODIC PROTECTION EQUIPMENT
BK

For complete information on Brance-Krachy rectifiers, instruments and other cathodic protection equipment, write, wire or call

Brance-Krachy Co. INC.
4411 NAVIGATION • HOUSTON • PHONE CA 5-6661

BRANCH OFFICES: CORPUS CHRISTI, 643 N. PORT, PH. TU 2-9451
BEAUMONT, 1050 RAILROAD, PH. TE 3-2679—TULSA, P. O. BOX 4593, PH. RI 3-2490

Pipelayer

Caterpillar Tractor Company announces the MD7 pipelayer having increased power and improved durability.

Among new features of the pipelayer is the transmission lubrication system including pressure-lubricated bearings, oil-sprayed gears, and full-flow filtration. Engine changes include the addition of a turbocharger, and dry-type air cleaner.

To be shown at the International Petroleum Exposition, Tulsa, May 14-23.

(This item supplements Caterpillar Tractor Co. data on pages 76-79 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E14** on Readers' Service Card, last page this issue.

Surge Control System

CDC Control Services, Inc. announces a compudyne surge control system for large compressors, blowers and exhausters which is designed to improve operating stability, reduce power consumption and increase safe output of equipment. The highly flexible, completely packaged system can be used on units from 50 horsepower up.

It consists of fully-electronic sensing, measurement, and control instruments, plus an electro-hydraulic or electric-pneumatic actuator and control valve as the final control elements.

For more data, circle **No. E15** on Readers' Service Card, last page this issue.

Acme-Newport Steel COMPANY

NEWPORT, KENTUCKY

A SUBSIDIARY OF ACME STEEL COMPANY

Acme-Newport plants at Newport, Ky. Cincinnati, Ohio is in background.

QUALITY LINE PIPE* FROM THE HEART OF AMERICA

Strategic location on the Mississippi-Ohio river system and the great Cincinnati rail-truck hub has contributed greatly to this basic steel producer's reliable service and steady growth over the last 75 years. Even more vital to our continued customer satisfaction are the many advances in technical skills, such as those demonstrated in today's production of electric weld line pipe. Quality control begins in the furnace itself and continues throughout rolling, pipe forming, welding and hydrostatic testing . . . to ensure pipe that exceeds specifications of API, ASTM and the individual customer.

Let us tell you more. See us at the International Petroleum Exposition, Booth 77N, or write

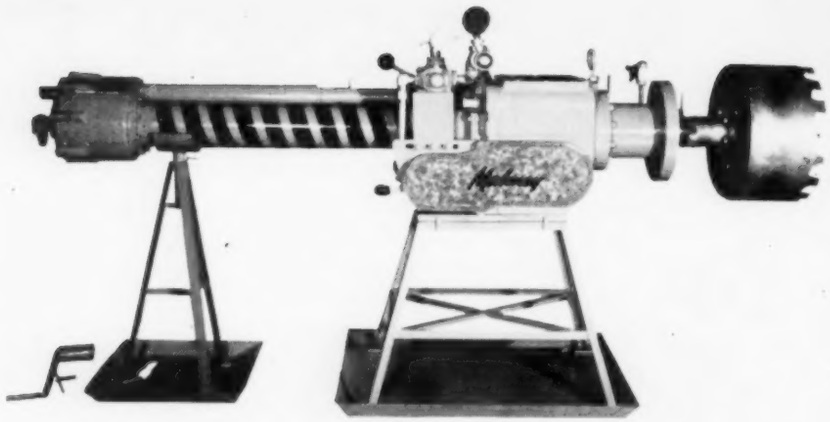
ACME-NEWPORT STEEL COMPANY, NEWPORT, KENTUCKY.

***SIZES AND WEIGHTS AVAILABLE**

O.D.	Wall	Wt. Per Ft.
4½	.125"	5.84
	.142"	6.61
	.156"	7.25
	.188"	8.64
	.219"	10.00
	.237"	10.79
6⅝	.156"	10.78
	.188"	12.89
	.219"	14.97
	.250"	17.02
	.280"	18.97

SEE OUR EXHIBIT

MAY 14-23, 1959
Tulsa, Oklahoma



Pipe Tapping Machines

F. H. Maloney has developed two high-pressure pipe tapping machines designed for rapid, accurate and safe hot tapping with complete power operation.

The Mark I unit, either air motor or hand crank power, covers the range of high-pressure taps from 1-inch through 6-inch diameter. It uses twist drill cutters to 3-inch diameter; shell type cutters are available up to 6-inch diameter. The Mark II unit uses air or hydraulic power coupled with revolutionary shell cutters to provide cuts from 4 to 16 inches in diameter.

(This item supplements F. H. Maloney Co. data on pages 269-272 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E16** on Readers' Service Card, last page this issue.

Another **BorTunCo** *Success Story:*

BorTunCo has an established record with engineers and contractors for capable sub-contract job performance.*

179,115 feet of **bores** and **tunnels**—ranging in size up to 12 feet in diameter—were completed in 1958 by **The Bortunco Group.**

Work was completed in **23 states** for **511** satisfied customers!

The Bortunco Group is the answer to your boring and tunneling problems.

Call our nearest office for a quote on your next job.

*Negotiations and inquiries strictly confidential.

THE BORTUNCO GROUP

BORING & TUNNELING BORTUN CO COMPANY of AMERICA

Road Boring and Tunneling Company, Inc.; Texas Road Boring Company of La.-Miss.; Boring and Tunneling Company of America; Texas Tunneling Company; Horizontal Holes, Inc.

BORING AND TUNNELING CO. OF AMERICA

2902 Ricks Road • P. O. Box 14214 • Houston, Texas • JA 6-2755

1320 Guinotte Ave. Kansas City, Mo.
5515 Redfield Dallas 35, Texas
P. O. Box 4755, Audubon Station Baton Rouge, La.
3492 W. Hospital Ave., Chamblee, Ga. — Atlanta Phone: GLendale 7-2368

Pipe Putty

Designed to take the sharp corners out of pipe fittings prior to the application of pipe protection tape, a new pipe putty has been introduced by Minnesota Mining and Manufacturing Co.

The new compound was developed to make the taping of irregular shapes such as tees and couplings better and easier. It provides a smooth taping surface, practically eliminating any wrinkles or buckles in the tape.

For more data, circle **No. E17** on Readers' Service Card, last page this issue.

Crawler Wheel Inserts

A synthetic rubber imported from Germany, with high resistance to abrasion and tearing, is being used by Crutcher-Rolfs-Cummings, Inc. for crawler wheel inserts.

The crawlers have been used in construction—one set completing a 108-mile, 24-inch line without an insert change.

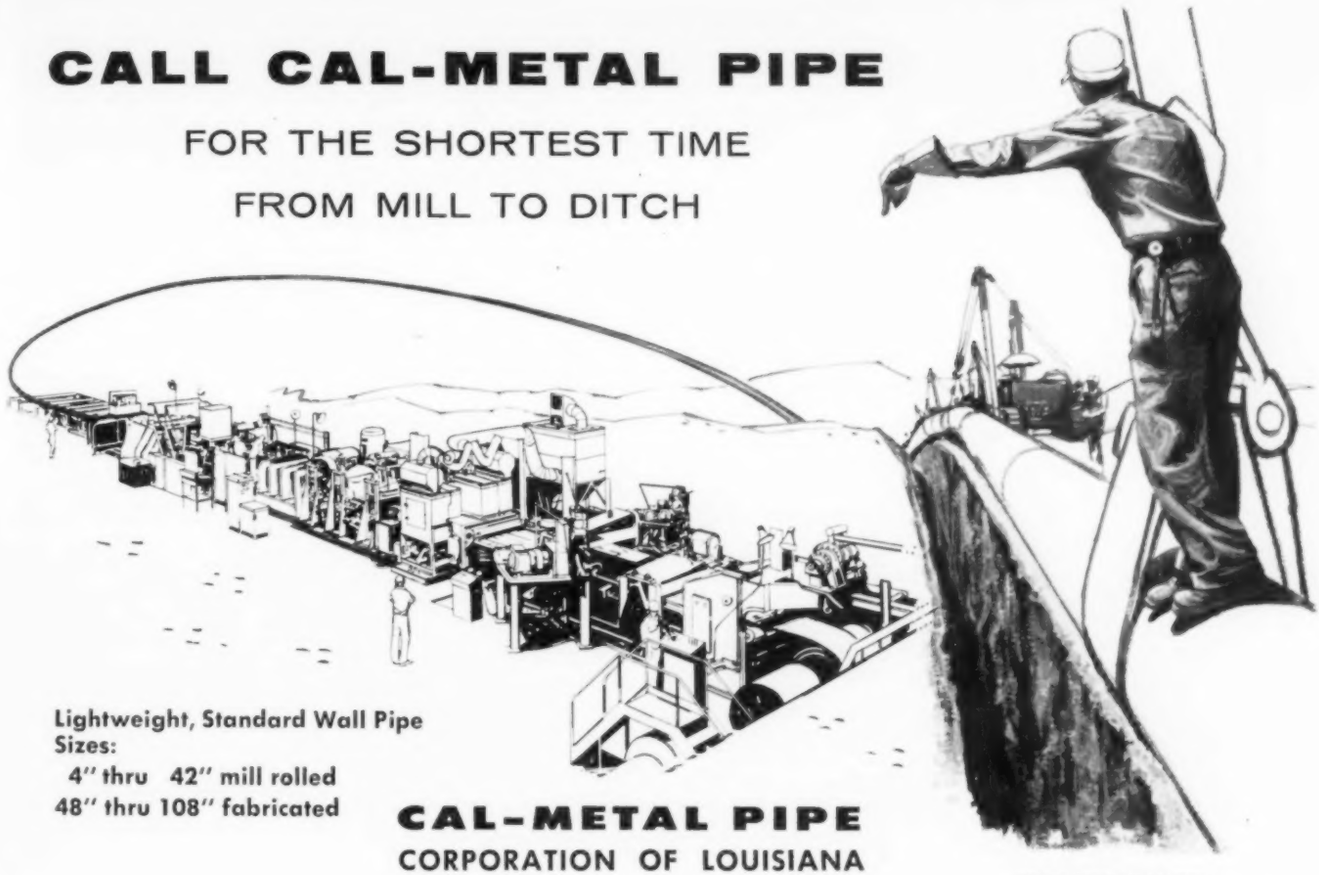
Standard equipment on C-R-C traveling cleaning and priming machines, they are available for 6, 7 and 9-inch wheels for pipe 3-inch to 36-inch.

(This item supplements Crutcher-Rolfs-Cummings, Inc. data on pages 139-142 of the Pipe Line Catalog, Second Revision.)

For more data, circle **No. E18** on Readers' Service Card, last page this issue.

CALL CAL-METAL PIPE

FOR THE SHORTEST TIME
FROM MILL TO DITCH



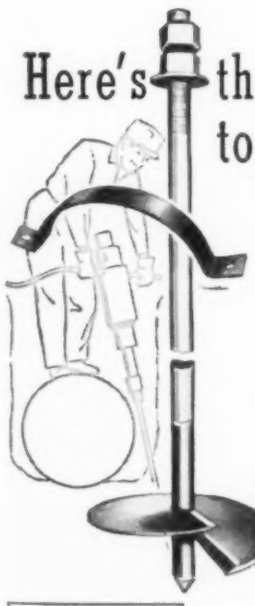
Lightweight, Standard Wall Pipe Sizes:
4" thru 42" mill rolled
48" thru 108" fabricated

CAL-METAL PIPE
CORPORATION OF LOUISIANA

Box 2548 • Phone: ELgin 5-7741
Baton Rouge, Louisiana

FIELD SALES OFFICES:
HOUSTON—4101 San Jacinto—JAckson 3-5361
TULSA—609 Mayo Building—LUther 4-2615

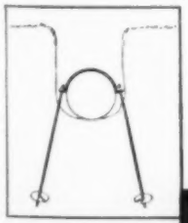
Here's the Fast Easy Way to Anchor Pipelines



No heavy equipment to haul. Cuts costs to a fraction.

Chance Pipe Line Screw Anchors and Brackets greatly simplify pipe line anchoring, compared to other methods, and save many dollars in pipe line construction.

Chance Pipe Line Screw Anchors can be installed in pipe line ditches without extra digging. Using a power wrench the operator merely guides the anchor in place. The tool does the work



Can be installed in the ditch without extra digging.

Write for catalog showing oil industry applications of Chance Earth Anchors.

A·B·CHANCE CO·
CENTRALIA, MISSOURI
TORONTO, ONTARIO, CANADA

CONTROL PARAFFIN with BrakeSol at LOW, LOW COST!

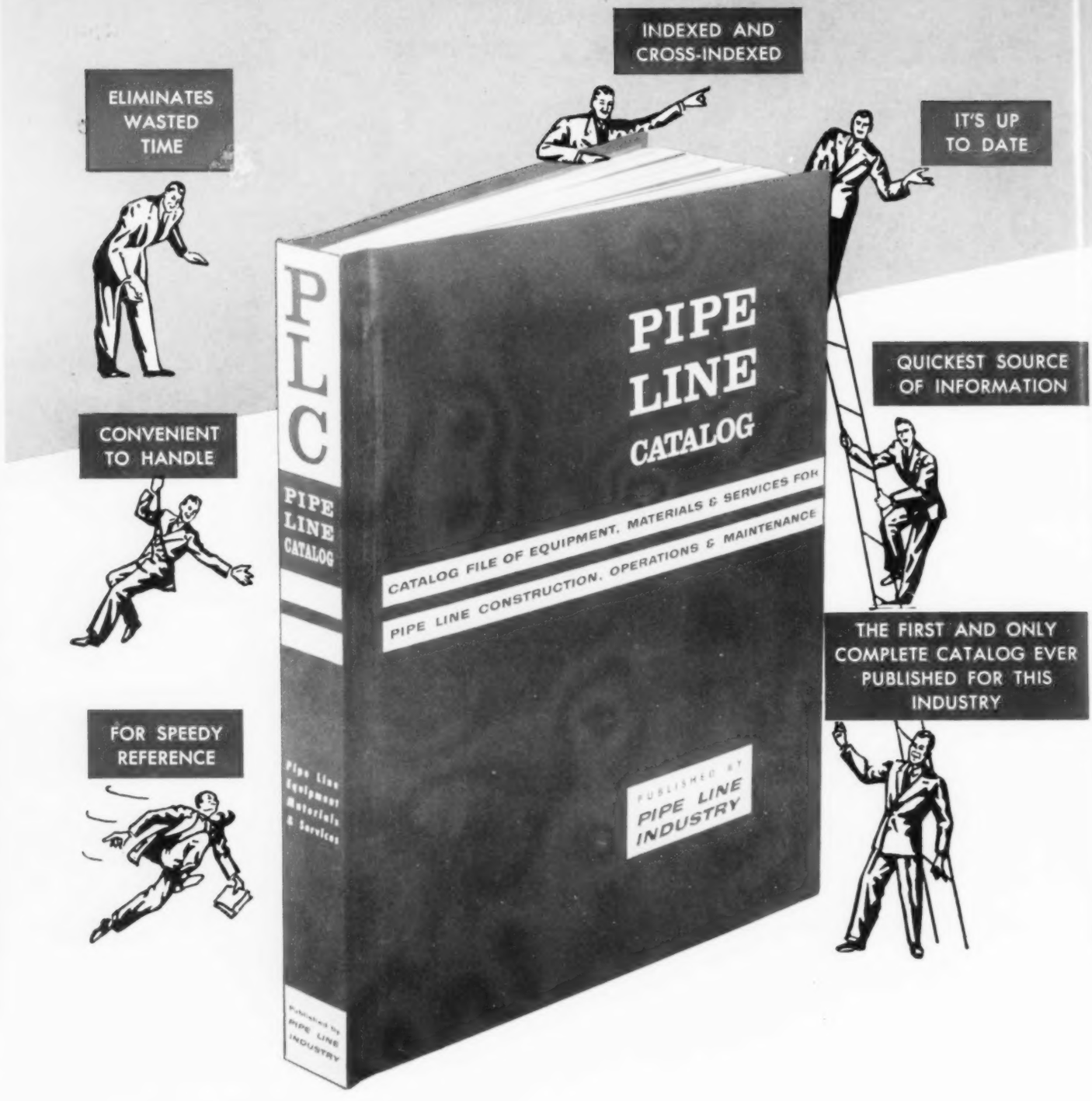
NOW is the time to set up a "control program" with the constant injection of economical BrakeSol. . . . the chemical that holds paraffin in suspension from formation to refinery.

BrakeSol is the most effective chemical for treating all types of paraffin conditions. It is approved by refiners . . . contains no chlorinated solvents or other organic halides or sulphides. Contact your nearby BrakeSol Treating Engineer or Supply Store for information on how your paraffin problems can be eliminated economically.

See our Exhibit at the IPE.

BrakeSol INC.

P. O. BOX 9506 • OKLAHOMA CITY, OKLA.
EXPORT DISTRIBUTOR: THE NATIONAL SUPPLY CO., EXPORT DIVISION


INDEXED AND CROSS-INDEXED
ELIMINATES WASTED TIME
IT'S UP TO DATE
PLC
PIPE LINE CATALOG
PIPE LINE CATALOG
CATALOG FILE OF EQUIPMENT, MATERIALS & SERVICES FOR
PIPE LINE CONSTRUCTION, OPERATIONS & MAINTENANCE
QUICKEST SOURCE OF INFORMATION
CONVENIENT TO HANDLE
THE FIRST AND ONLY COMPLETE CATALOG EVER PUBLISHED FOR THIS INDUSTRY
FOR SPEEDY REFERENCE
PUBLISHED BY
PIPE LINE INDUSTRY

The only catalog data file being published especially for the Pipe Line Business is a real success. It is serving as a genuine time saver for operating and field executives, superintendents, foremen, engineers, purchasing agents and many others who buy or specify equipment and materials.

More than 165 leading companies have filed their complete or condensed catalogs in this useful volume. Compiled by the manufacturers themselves, this information is arranged and indexed to offer a quick and convenient means of locating *what you want when you want it.*

If furnished to you in individual brochures, bulletins or specification sheets, the information that is now condensed into this composite catalog file would fill the equivalent of several file drawers or book shelves.

On the opposite page you'll find a complete list of the companies that have filed data in the specialized Pipe Line Catalog. When you are looking for sales information, be sure to check these companies in your Pipe Line Catalog. It is the most complete source of buying information available in one volume for this industry today..

ACF Industries, Inc., W-K-M Div.
Aerotec Corp.
Aitken, M. N. Company
Aldrich Pump Co.
Allied Chemical, Plastics & Coal Chemical Division
Allis-Chalmers Mfg. Co.
Alston Mfg. Co.
American Blower Division American-Standard
American Cable Div. American Chain & Cable Co., Inc.
American Chain & Cable Co., Inc. R-P & C Valve Div.
American Cyanamid Co. Jefferson Chemical Co. Inc. Subsidiary
American-Marietta Co.
American-Standard, American Blower Division Norwood Controls Unit Detroit Controls
Anchor-Wate
Anderson, V. D. Co.
Andrews Tower, Inc.
Automatic Power Inc.

Barber-Greene
Beaird J. B. Co. Inc.
Bethlehem Steel Co. Supply Div.
Bettis Corp.
Bonney Forge & Tool Works
Borg-Warner Corp., Byron Jackson Div.
Bucyrus-Erie Co.
Buffalo-Eclipse Corp., Penberthy Mfg. Co. Div.
Byron Jackson Pumps Inc. Subsidiary of Borg-Warner Corp.

Carver-Stimpson Pipe Cleaning Co. Inc.
Caterpillar Tractor Co.
Cathodic Protection Service
Central Plastics Distributing Co.
Centrifix Corp.
Challenge Mfg. Co.
Chance, A. B. Co.
Charles Machine Works, Inc.
Chemetron Corp., Tube Turns Division
Cherokee Laboratories, Inc.
Clark Bros. Co., One of The Dresser Industries
Coffing Hoist Div., Duff-Norton Co.
Colorado Fuel & Iron Corp. Wickwire Spencer Steel Div.
Commercial Iron Works
Cooper-Bessemer Corp.
Corrosion Services Incorporated
Corrosion Rectifying Co., Inc.
Cotten, G. A. Co.
Crane Co.
Crose, M. J. Mfg. Co. Inc.
Crutcher, Rolfs, Cummings, Inc.

Darling Valve & Mfg. Co.
Day, S. D. Co.
Dresser Industries, Clark Bros. Co. Div. Magnet Cove Barium Corp. Div.
Duff-Norton Co., Coffing Hoist Div.
Dunlap Mfg. Co.
Duriron Co. Inc.
Dutch Brand Div., Johns-Manville Corp.

Edison, Thomas A. Industries, Instrument Division
Allan Edwards, Inc.
Elliott Co., Ridgway Division
Elsey Mfg. Co.
Ensign-Bickford Co.

Falk Corp.
Farrel-Birmingham Co., Inc.
Flexitallic Gasket Co.
Fluor Products Co.
Fram Corp., Warner Lewis Co. Div.

These leading manufacturers, suppliers and service companies have filed complete or condensed catalog data in the current edition of the new PIPE LINE CATALOG. See their detailed information in the catalog when you are ready to buy.

Gardner-Denver Co.
Garrett Oil Tools, Inc., Division of U. S. Industries, Inc.
Gaso Pump & Burner Mfg. Co.
Gasoline Plant Construction Corp.
Gearench Mfg. Co.
General Descaling Co., Ltd.
General Electric Co., Apparatus Division
Gorman-Rupp Co.
Greenhead Sling & Supply Co.
Greenwood Valve Division Vernon Tool Co., Ltd.
Grove Valve & Regulator Co.

H & M Pipe Beveling Machine Co.
Hamer Valves, Inc.
Hercules Motors Corp.
Homelite, Division of Textron Inc.
Horton Equipment Co.
Hudson Engineering Corp.
Humble Oil & Refining Co.
Hydril Co.

Indus Corp.
Ingersoll-Rand
Instruments, Inc.

Jefferson Chemical Co., Subsidiary of American Cyanamid Co.
Johns-Manville Corp., Dutch Brand Div.

Kellogg, Communications Division of ITT
Kinzbach Tool Co., Inc.
Knudsen, Vic Co.

L & M Company
Ladish Company
Ledeen Mfg. Co.
Leland Equipment Co.
Lewis, Warner Co. Div. of Fram Corp.
Lloyd Metal Foundry

Magnet Cove Barium Corp. One of The Dresser Industries
Magnetrol, Inc.
Mallay Tool Service
Maloney, F. H. Co.
MAREP, S. N.
Marsh Instrument Co.
Mason-Neilan Div. of Worthington Corp.
Mathey, C. A. Machine Works, Inc.
Mavor-Kelly Company
McCord Corp.
McFarland Engineering & Pump Co.
McFarland Mfg. Corp.
McKissick Products Corp.
Mercoid Corp.
Midwestern Manufacturing Co.
Midwestern Pipe Line Products Co.
Mine Safety Appliances Co.
Mixing Equipment Co., Inc.
Morris-Young-Owens Co.
Murphy, Frank W. Mfr. Inc.

National Tank Co.
Naylor Pipe Co.
Nickles Machine Corp.
Norwood Controls Unit, Detroit Controls Division of American-Standard

Oil Well Supply Div. of U. S. Steel

Peerless Mfg. Co.
Pelican Supply Co., Inc.
Penberthy Mfg. Co., Division of Buffalo-Eclipse Corp.
Perrault Equipment Co.
Petrolite Corp., Tretolite Co. Div.
Philco Corp., Government & Indus. Div.
Philip Carey Mfg. Co.
Pipe Line Development Co.
Pittsburgh-Des Moines Steel Co.
Plastics & Coal Chemicals Division of Allied Chemical
Portable Bridge & Equipment Co.
Pottermeter Co., Division of Potter Aeronautical Corp.
Protecto Wrap Co.

Quality March Equipment Co., Inc.

R-P & C Valve Div., American Chain & Cable
Ramsey Winch Mfg. Co.
Ray-Test Engineers, Inc.
Reilly Tar & Chemical Corp.
Remco Manufacturing Co.
Ridgway Div., Elliott Co.
Rig Engineers & Fabricators Co., Inc.
Riggs, Wm. L. Co.
Robishaw Engineering Inc.
Rochester Manufacturing Co., Inc.
Rolo Manufacturing Co.
Ruberoid Co.

Shafer Valve Co.
Skinner, M. B. Co.
Sooner Boomer Mfg. Div.
Southern Mill & Mfg. Co.
Sprague Engineering Corp.
Standard Magnesium Corp.
Staytite Co.
Stearns, D. E. Co.
Stearns, N. C. Co.
Steel Forgings, Inc.
Stewarts & Lloyds Ltd.
Superior Equipment Co.
Sewco, Inc.

Textron, Inc., Homelite Division
Thermix Corp.
Thornhill-Craver Co., Inc.
Tinker & Rasor
Tretolite Co. Div. of Petrolite Corp.
Tube Turns Div. of Chemetron Corp.

Union Switch & Signal Div. of Westinghouse Air Brake Co.
U. S. Industries, Inc., Garrett Oil Tools, Inc. Division
United States Motors Corp.
United States Steel Corp., Oil Well Supply Division
Universal Oil Products Co.

Vereinigte Armaturen-Gessellschaft MBH
Vernon Tool Co., Ltd. Greenwood Valve Division
Voss, J. H. H. Co., Inc.

W-K-M Div. of ACF Industries, Inc.
Wachs, E. H. Co.
Waldron, John Corp.
Waukesha Motor Co.
Westinghouse Air Brake Co., Union Switch & Signal Division
White Diesel Engine Division The White Motor Co.
Whitmore Homebuilders, Inc.
Wickwire Spencer Steel Division The Colorado Fuel & Iron Corp.
Wilkinson Products Co.
Williamson, T. D. Inc.
Worthington Corp.
Worthington Corp., Mason-Neilan Division

Yale Machine Works

Zeligson Truck & Equipment Co.

PIPE LINE CATALOG

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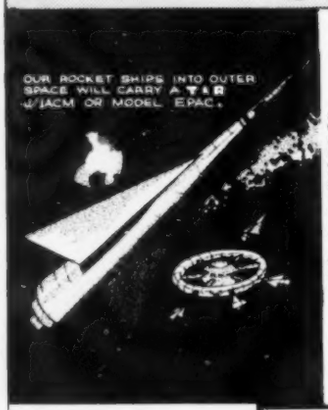

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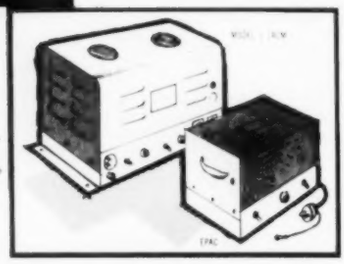

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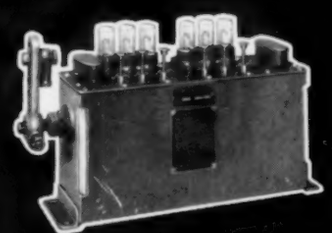

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New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Prefabricated Buildings

Coseley Buildings, Limited, has issued a 28-page brochure giving detailed information on the complete line of Coseley prefabricated steel buildings.

The highly illustrated booklet gives engineering data and specifications including drawings and installations data on doors, windows, foundations, partitions, insulating, ventilation, structural details and various types of siding and colors available.

To get a copy, circle **No. E19** on Readers' Service Card, last page this issue.

Pipe Line Backfiller

Cleveland Trencher Co. announces a six-page fold-out brochure on its pipe line Backfiller. The bulletin describes Cleveland's new throw-out clutch which is cooled by continuous circulation of water from the engine's cooling system.

Illustrations show the Cleveland 190 backfilling heavy spoil on big pipe lines. Another improvement in the 190 is the repositioning of the boom hinges above the crawler tracks to keep them free of mud, muck and water, providing better control.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

Seal Tube Fittings

A hydraulic pneumatic and vacuum catalog containing flow charts, J.I.C. piping, and helpful information on engineering and maintenance departments has been published by Lenz Company.

The catalog includes data on the Lenz "O" Ring seal tube fittings, flare fittings, pipe fittings, tube benders, and other hydraulic components.

To get a copy, circle **No. E21** on Readers' Service Card, last page this issue.

Warning Signs

California Metal Enameling Company has published a color catalog illustrating its complete line of warning signs.

Included are the 65 danger worded signs, 16 caution signs, and 62 miscellaneous warning signs. Sizes range from 3-inch by 10-inch to 40-inch by 30-inch with gages from 22 to 18, depending on the sign size. A special section on reflectorized truck traffic signs is included.

The CAMEO warning signs are porcelain enamel on steel.

To get a copy, circle **No. E22** on Readers' Service Card, last page this issue.

Forged Steel Unions

A new forged steel union catalog covering the line of W-S unions is now available from W-S Fittings Works, Forge and Fittings Division, H. K. Porter Company, Inc. It provides detailed specification data on all types, sizes, materials and pressure ratings.

The catalog includes the latest additions to the W-S line. Included is the new 3000, offered in types 304 and 316 stainless in accordance with A.S.T.M. A-182.

To get a copy, circle **No. E23** on Readers' Service Card, last page this issue.

Kab Kooler

A four-page folder describing the self-powered, self-contained truck cab air conditioner has been released by D. W. Onon & Sons, Inc.

The two-color bulletin describes and illustrates typical installations of this modern air conditioning unit on truck cabs, cranes and shovels, field offices and other vehicles of a size that fits the unit's cooling capacity.

A brief explanation of installation and servicing procedures is also given.

To get a copy, circle **No. E24** on Readers' Service Card, last page this issue.

Electronic Instruments

The Bristol Company has released a new edition of its bulletin on dynamaster electronic instruments. Complete specifications of Bristol's potentiometer and bridge instruments in indicating, recording and controlling models are given.

Information concerning Bristol's new rack mounting instruments, high speed and multi-point instruments, and miniature instruments is included, in addition to description of standard round-chart and strip-chart instruments.

To get a copy, circle **No. E25** on Readers' Service Card, last page this issue.

Pushbutton Stations

Allis-Chalmers has released a two-page flier on its NEMA type 4 and 5 pushbutton stations and pilot lights. Designed to operate successfully under toxic conditions, the surface mounted pushbutton stations consist of molded phenolic enclosure case and cover, and neoprene gasket and type 316 stainless steel hardware components which make them impervious to most chemical conditions.

To get a copy, circle **No. E26** on Readers' Service Card, last page this issue.

Synchronous Motors

General Electric Company has issued a four-page bulletin on high-speed synchronous motors. The bulletin describes in text and illustrations, design features, construction and application of constant speed motors for commercial and industrial use. Illustrations show manufacturing techniques and typical installations.

To get a copy, circle **No. E27** on Readers' Service Card, last page this issue.

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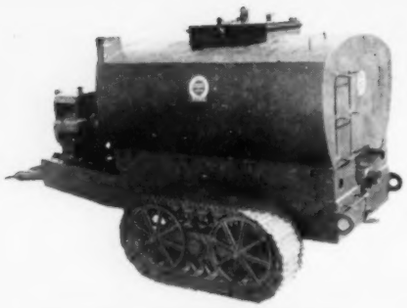
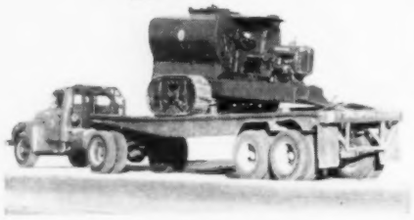


HOT DOPE

FROM

MYOCO

KETTLES



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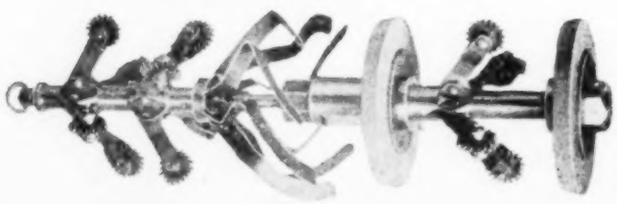
Heavy Duty Model with Neoprene cup or disc drivers



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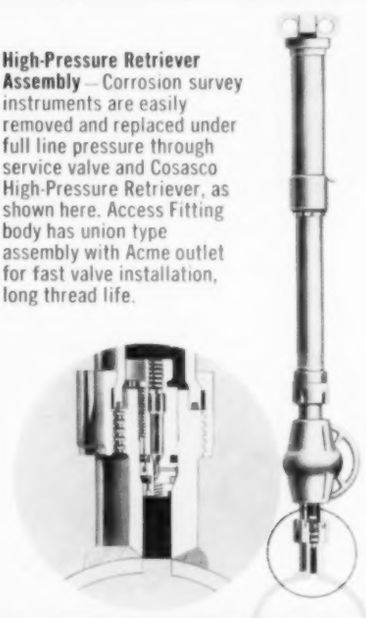

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